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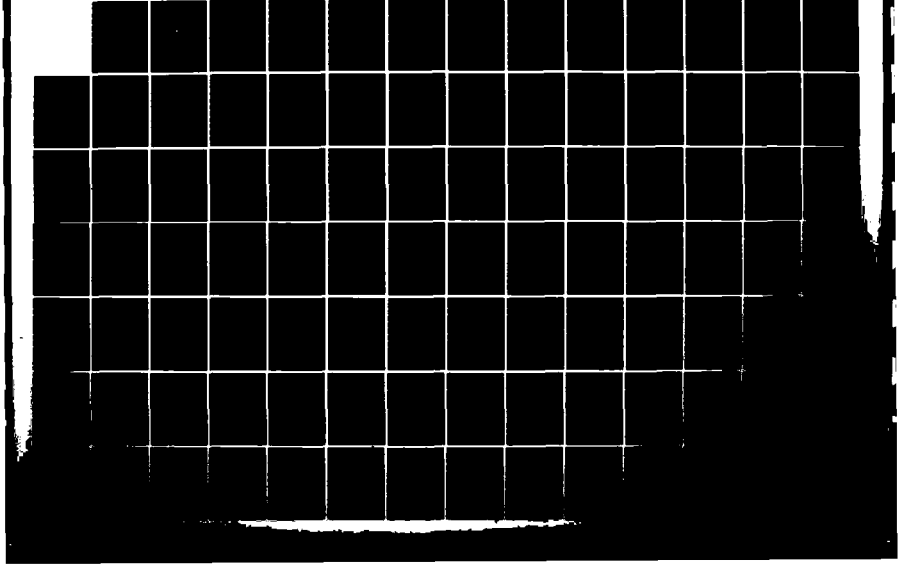

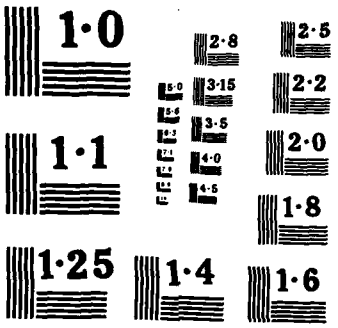

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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

PROTOTYPING WITH DATA DICTIONARIES
FOR REQUIREMENTS ANALYSIS

by

Alan F. Noel

March 1985

Thesis Advisor: Daniel R. Dolk

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The analysis of software system requirements is to develop a complete, consistent and unambiguous statement for what the software will do, but not how. Failure to correctly elicit requirements is cause for difficult and expensive correction efforts during later phases of system development. An alternative approach to interviewing and textual document preparation is the use of a functionally limited model, a prototype.

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ABSTRACT (Continued)

This thesis will examine the feasibility of using prototypes accompanied with data dictionaries as a more effective means of communicating with users and, therefore, more correctly eliciting requirements. It will include development of a relational based, prototype data dictionary using the dBASE II database management system. The dictionary is for use by the Deputy Chief of Staff for Plans, U. S. Army Military Personnel Center, Alexandria, Virginia.

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Prototyping With Data Dictionaries For Requirements Analysis

by

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The analysis of software system requirements is to develop a complete, consistent and unambiguous statement for what the software will do, but not how. Failure to correctly elicit requirements is cause for difficult and expensive correction efforts during later phases of system development. An alternative approach to interviewing and textual document preparation is the use of a functionally limited model, a prototype.

This thesis will examine the feasibility of using prototypes accompanied with data dictionaries as a more effective means of communicating with users and, therefore, more correctly eliciting requirements. It will include development of a relational based, prototype data dictionary using the dBASE II database management system. The dictionary is for use by the Deputy Chief of Staff for Plans, U.S. Army Military Personnel Center, Alexandria, Virginia.

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I. INTRODUCTION

The analysis of requirements has been, and continues to be, a source of difficulty in developing software. The impact of improper analysis is far reaching. Consequently, considerable effort has been put into developing methodologies to elicit and accurately capture what is needed and wanted. The traditional strategy for conducting requirements analysis has been to interview users individually and then to document, in ordinary English, the users' needs. The result of this process is a large tome of requirements that is seldom understood in its entirety. However, requirements analysis is the foundation effort for any software system and therefore of particular importance for achieving project success. The foundation is provided by uncovering the flow and structure of data.

The software to be built it described by several completion of several actions. Design constraints must be identified to bound the problem and clarify its scope. Functions and data must be described to permit an understanding of the essence of the system to be automated. Interface details for hardware, software, human beings and procedures must be developed to integrate the software into the encompassing system or organization. Important to describing the software is establishing and maintaining communications with both the eventual user and the originating requestor. The information flow and structure becomes a tool that leads to an overall representation of the software which will be developed. Thus, the design process is fed the output of the requirements analysis effort. The continuity of the effort and the quality of the design are heavily dependent on the requirement specification. [Ref. 1]

There are several problems with the requirement analysis effort as exercised in the traditional software life cycle. First, users' needs may change significantly during development. This can occur through a natural evolution of the organization or through interaction with the software development effort. Secondly, the user has no system during the period between the solicitation of requirements and delivery of the completed system. The user has no clear picture of what he will be getting because he has only been dealing with abstract terms and representations, nothing that actually behaves like the real system. [Ref. 2]

The reasons for some of these problems are known. The people involved do not share the same frames of reference because analysts and end-users come from different cultures. An analyst can be viewed as a missionary steeped in computer technology. An end-user is only concerned with getting the job done within his particular business area. The two usually do not understand each others' area of expertise and a great deal of learning, particularly for the analyst, must take place. The product resulting from the interaction of an analyst and a user is often a document of which too much is expected. The medium of a textual document may capture many relevant details, but it may not in turn communicate them with sufficient clarity to permit true understanding. A specification document is often too long; contains technical terms the user does not know; contains words with different meaning to users and analysts and often also contains trivia and motherhood statements which sound good but offer no real benefit. A textual specification can be particularly lacking regarding interactive systems because a document cannot capture the dynamic quality of the user interaction.

Nevertheless, the textual document as a requirement specification is the basis for all follow on work. This

work cannot be correct if its basis is inaccurate. Despite users not always understanding the specifications, they are often coerced into signing and approving the document because the developers refuse tc go forward without a signature. The developers feel it is necessary to have user approval and the requirements frozen to prevent having to make changes which increase system cost further along in the development process. However, the freezing of requirements specifications causes apprehension for both users and developers. Developers either intuitively feel or know from experience that the act of providing what an end-user needs, and the follow on design and coding effort, changes his perception of those needs. The solution to a problem can change the problem [Ref. 3]. The essence of the problem of inadequate requirement specifications is the incomplete communications between the user and the analyst. The evidence that inadequate communications is still a problem lies in the fact that software software development projects still suffer from poorly defined specifications despite the considerable effort that has been expended in in developing and using rigorous methodologies. Some observers feel the failure rate is just as high as it was 15 years ago and that most development is a trial and error process [Ref. 4].

Requirements specifications can take one of three forms. The traditional approach is to develop a textual list of "shall statements" the system must fulfill. A major disadvantage of the textual approach is the psychological distance from what the user will eventually receive. A document does not convey a realistic sense of how the system will fit the user's needs. This is especially true for interactive systems. Textual specifications take a static view in attempting to capture or freeze the situation. Most users cannot fully describe their current requirements and even fewer can identify their future needs. A more recent

innovation is the use of an interpretive model. An example of this approach is the Structured Analysis Design Technique which uses a set of graphical representations. Other interpretive modeling techniques are the use of data flow diagrams, flowcharts and Nassi-Schneidermann charts. These approaches, although an improvement over the textual, still do not adequately communicate on line-interaction. Using more detailed graphics places more burden on the users than it helps. However, users know what would be useful if they saw it [Ref. 5]. A useful approach is to develop a working model, a prototype. The development of higher level languages and the lessening cost of hardware have recently given rise to a requirements analysis approach which offers promise of assisting in the communications problem. This technique is prototyping.

Chapter 2 is devoted to explaining the concept of prototyping. A key to successful prototyping, if not all systems analysis, is the capture of data about the data in some form. Data dictionaries are the means most often used for organizing this "metadata". Chapter 3 will discuss metadata and data dictionaries and their potential role in the system analysis and design process. By explaining prototyping and data dictionaries we will show the two as an inseparable pair which are an important adjunct to the system development process. The culmination of this thesis is chapter 4 wherein we develop a general, relational-based design of a data dictionary for use with prototyping for requirements analysis. This dictionary will be implemented using dbase II, a micro-oriented relational database management system.

II. PROTOTYPING FOR SOFTWARE REQUIREMENTS

A. DEFINITION OF PROTOTYPING

Webster's dictionary defines a prototype as one of three possible things:

1. An original or model after which anything is formed
2. The first thing of its kind
3. A pattern, an exemplar, an archetype

The second definition is probably the most relevant to this discussion because prototypes are being used in data processing as a first attempt at a design which is then extended or enhanced. In general systems development, a prototype is known as

> "...a partially complete functional model of a target system whose purpose is to provide a better understanding of the target system's requirements" [Ref. 6].

A software prototype is characterized by the following features. It is a working system, although of limited capability, rather than just an idea on paper. A prototype may become, after iterative enhancement, a production system. Its original purpose is to test out assumptions about requirements and/or system design architecture. A prototype is created quickly. This has become possible only in recent years with more powerful languages which are less procedurally oriented. Some would argue however, that prototyping was the way software was developed before the advent of functional decomposition and the system development life cycle which is generally accepted and used today.

> "In the early days of software development writing programs was the thing to do. After an explanation of the problem, a period of questions and answers, and research into the nuts and bolts of a method, the programmer began his or her work. Starting with that portion of the problem that was well understood, lines of FORTRAN, COBOL or ALGOL would begin to appear. As time passed additional portions were coded until the entire program was complete. Design was conducted implicitly, if at all! " [Ref. 7]

A prototype should be inexpensive to build, at least less than it would cost if a conventional high level language were used. Indeed, prototyping in data processing originated only recently because until now programming a prototype was just as costly as programming the working system [Ref. 8]. The important point is to get something running soon to establish effective communications with the user without the use of extravagant resources. The follow on development of a prototype is an iterative process in which improvements are made in small increments as the user and developer work together and discover new requirements [Ref. 9].

Mitchell Spiegel, formerly of Wang Laboratories, explains the prototyping approach as:

> "...a process of modeling user requirements in one or more levels of detail, including working models. Project resources are allocated to produce scaled down versions of the software described by requirements. The prototype version makes the software visible for review by users, designers and management. This process continues as desired, with running versions ready for release after several iterations. " [Ref. 10]

Traditional management information system development follows a series of steps (see Figure 2.1). Prototyping is considered as an adjunct activity to the specification of requirements (see Figure 2.2). The results of prototyping are input to the steps following requirements analysis, but may or may not be used actively in those steps.

Three alternatives are possible for the disposition of a prototype. Having served the purpose of facilitating

requirements definition the prototype can be discarded. The lessons learned are transferred to a requirements specification and development of the system then follows the traditional system development cycle. A second alternative is to maintain the prototype and run it in parallel with the developing target system. The benefit of this choice is the availability of a partially functional system to the users until the fully capable system can be delivered. Lastly, the prototype can continue to be iteratively refined to become the target system. This alternative is usually only feasible in management information systems as opposed to embedded software, such as weapon control systems [Ref. 11]. Some would argue that the term prototype should only be applied to those instances where the system is to be thrown away, otherwise it is more appropriate to term the activity as evolutionary development [Ref. 12]. The purpose of the distinction is to insure that only the right decisions are kept and transferred to the requirements specification while the mistakes, especially those causing poor execution efficiency, are left behind with the prototype.

B. ADVANTAGES OF PROTOTYPING

There are several advantages associated with the use of prototyping. The primary argument for using prototypes is that the specifications which result are more complete because users can evaluate a prototype better than they can evaluate written specifications. In using the prototype the users encounter and think about problems they will have with the production system [Ref. 13]. Another benefit is that prototyping allows and encourages users to change their minds about what they want. Consequently, the eventual system is better customized and therefore more useful. This relates to the idea that the development process itself

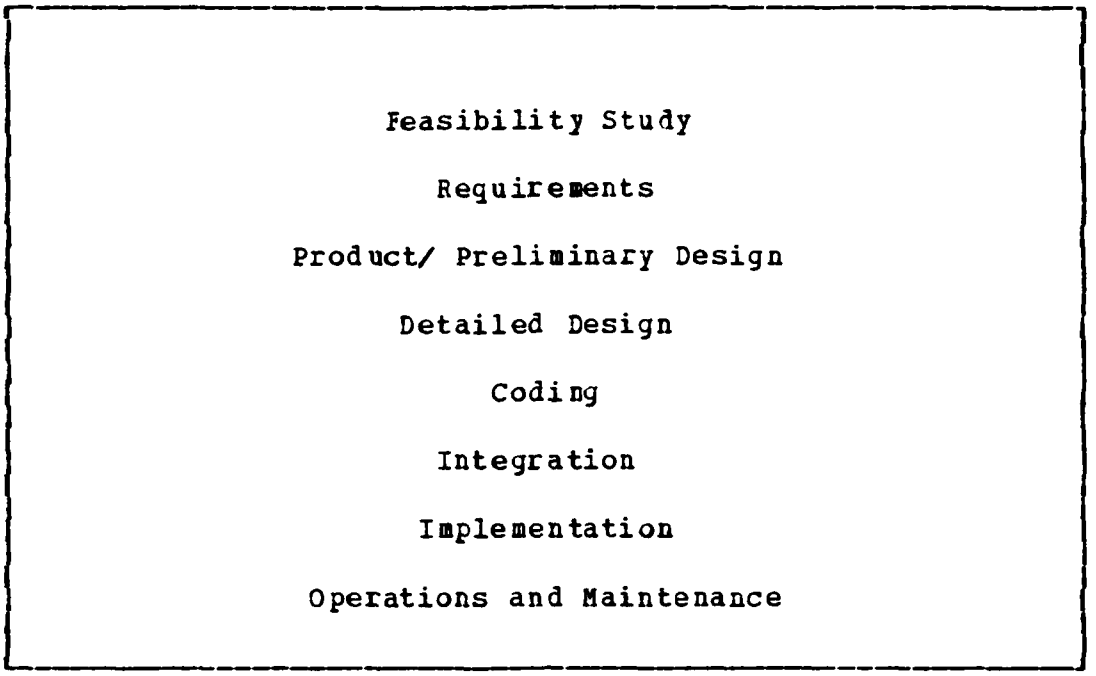


Figure 2.1 Steps in Traditional System Development

changes the users' perceptions of what is possible, increasing their insights into the development process and affecting it. In fact, this idea is a loose corollary of the Heisenberg Uncertainty Principle which states that any system development activity inevitably changes the environment out of which the need for the system arose [Ref. 14]. Some argue that prototyping eliminates the surprises at the end of the traditional development process because specifications, some being erroneous, haven't been frozen and pursued without correction. Another argument is that prototyping shortens the development cycle, but experience to date has found this not always to be the case and that prototyping only more clearly defines what has to be done. Of importance to those suffering with technically oriented data processing personnel who have difficulty relating to people is the benefit that prototyping does not

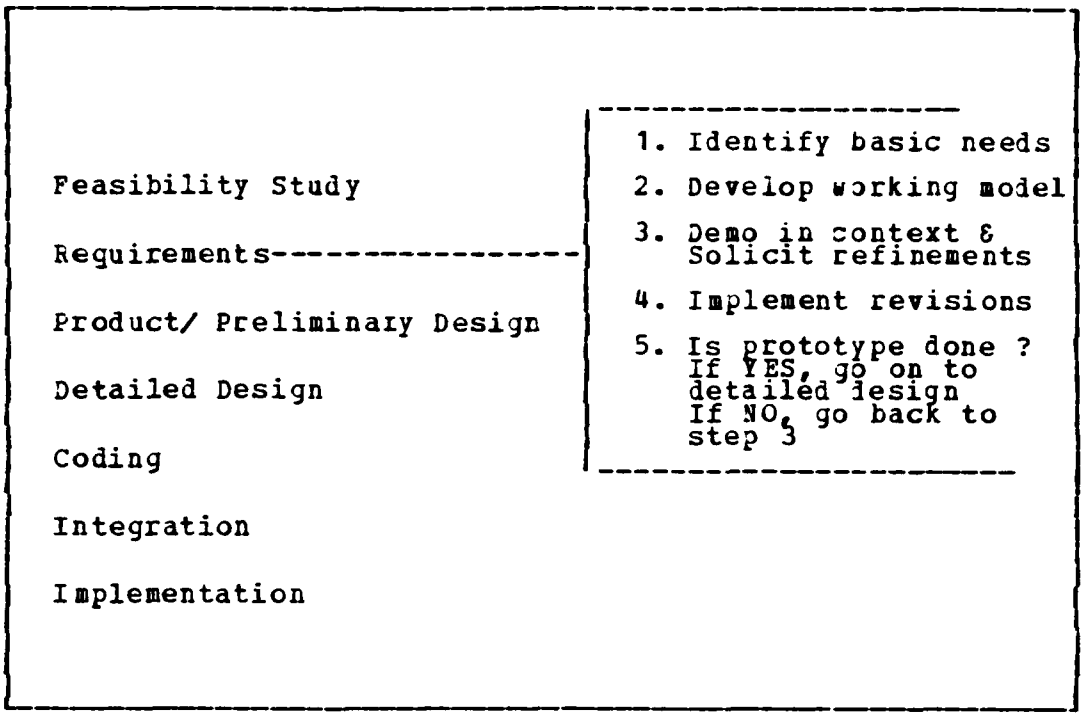


Figure 2.2 System Development Using Prototyping

require interviewing skills to the same degree as a traditional method of defining requirements. Also, because prototyping requires spending more time with users, the systems analysts are forced to become more user oriented and aware of the user's environment.

The emphasis on the user is the key issue here and further benefits are possible. The availability of a prototype enables the user to evaluate the human interfaces in practice and suggest changes. The user gets a more personalized system, regardless of the efficacy of the changes suggested. Thus the user is more willing to accept the eventual system having the perception that he truly affected its shape.

A working prototype enables the developer to evaluate the users' performance with the human interface and to

modify it to minimize errors. Experimentation is facilitated by implementing alternative interfaces without having to suffer the tedium of drawing specification graphics of one sort or another.

It is possible to generate human-machine dialogues and to make minor changes quickly.

The existence of a prototype gives the user a more immediate sense of the proposed system and encourges him to think more carefully about both the needed and the desirable characteristics of the system. It is easy to write statements in a requirements document which say "the system shall do x" and "the system shall be capable of y". However, both the developer and the user get a more realistic feeling for the effort and cost of a feature when they must actually add it to a working model. Thus, the eventual model better represents what is feasible than a document with a series of "shall statements". It is particularly significant to note that in a typical development effort there is a long time between analysis and construction. The user only has a limited idea of what the system will do in such a case. Therefore, it's difficult for the user to be specific when dealing only with abstract terms. Even though the functionality of a prototype system is minimal the user is forced to think more carefully about the task being automated. This should produce a more accurate understanding of the problem [Ref. 15]. The biggest argument for prototyping is that, unlike traditional methods, it builds an effective bridge across the communications gap between the user and the analyst.

C. DISADVANTAGES OF PROTOTYPING

Prototyping has some decided disadvantages as well. Prototyping makes it difficult to plan resource use because

a clear path of what you will be doing and when isn't provided. It also makes it difficult to decide whether to enhance an old system or build a new one. Analysts and users can become bored after the nth iteration of the prototype. In using the traditional development process there are specific requirements which, when met by proof of validation, clearly mark the job as complete. Because the prototype is changing continually, it creates a problem keeping users abreast of the current version.

Prototyping can cause a reduction in discipline for proper documentation and testing. Because there is less emphasis on hard thinking and "desk checking" there is a greater chance of missing a basic problem which could negate assumptions essential to the design being developed. For large systems it is often not clear how the problem can be divided up so it can be prototyped a piece at a time until a traditional requirements study has been made. Also there is the chance users may become so happy with the prototype they consider it a functional product and want the data processing people to start work on something else. This can create a higher initial cost for the requirements phase and possible loss of the distinction between this phase and the design phase.

A study using the ACT/1 software package for prototyping showed increased needs for computing resources. If the productivity gained from using prototyping doesn't offset the cost of the increased computing power, then the prototyping approach is serving at a disadvantage. [Ref. 16]

D. APPLICATIONS AND GUIDANCE FOR PROTOTYPING

Prototypes can be usefully applied to several different tasks associated with requirements analysis. These tasks are as follows [Ref. 17] :

1. A prototype can be used to discover the optimum structure for the data about data (metadata). This relates to the engineering use of prototypes as an experimental model from which to learn.
2. The prototype can serve as a basis for bottom-up integration.
3. They can be used to define macros that compute or derive new data from stored data. Abstracting in this manner is a process of deriving macros from a database. The database is enhanced having these macros incorporated into it.
4. Prototypes can be used to validate domains. This is particularly important if there is going to be an active data dictionary which will assist in ensuring data integrity.
5. Prototypes can be used to evaluate both update and retrieval efficiency.
6. They can be used to improve the physical database design.
7. They can be used to anticipate changes. This means to conduct experiments and step through what the user will do with the system to gain insight into how his use will foster new requirements, be they modifications or enhancements.
8. They can be used to facilitate implementation and acceptance of a new system.

If any of the items listed above seems sufficient to warrant a prototype then several conditions should exist to make prototyping an appropriate choice. These conditions are as follows:

1. The user's requirements can only be defined with much study.
2. The user's needs are expected to change often.
3. The user is willing to cooperate with the prototyper in answering questions.
4. Users are willing to accept the prototype as an adequate and temporary solution until an optimized and tested system can be delivered.
5. The area of study is well defined. Although in depth aspects of a problem aren't known, the width or scope is confined to a particular business area. Prototypes aren't appropriate for developing information systems strategies for an entire enterprise.
6. The user has a limited set of objectives. Projects of large size with many different applications areas are not appropriate choices for use of the prototyping methodology. The project must first be functionally decomposed to identify specific business areas.
7. A data dictionary is available for use. Preferably an automated, easy-to-use dictionary is available to facilitate easy recording of specifications, data entities, procedures and whatever else is necessary to model the information needs of the user [Ref. 18].
8. Complete honesty exists between the user and the prototyper. If the user isn't satisfied, he should say so and be specific. Further, the prototyper should admit ignorance and misunderstanding. If the answer is no to a particular feature because it isn't technically feasible, it should be so stated and explained, not ignored. The developer must be willing to interpret user difficulties as requiring re-examination of the application, rather than

"educating" the user, i.e. converting the user to the developer's concept [Ref. 19].

Regarding the last point above, technical people are generally deeply involved with their own inventive processes and the reasons for their choices, and therefore are not inclined to consider other roads which also admit acceptable solutions.

E. TOOLS FOR PROTOTYPING

Prototyping to define system requirements is a methodology. A methodology is a combination of tools and techniques employed within an organizational and managerial framework that can be consistently applied to successive information system development projects [Ref. 20]. A requirements analysis tool is any set of procedures, manual or automated, that guides an analyst through requirements specification. A manual tool is a well defined technique usually with a mode of graphic representation. An automated technique is often a specification language that combines keyword indicators with a natural language feature. There is also sometimes a specification language which, when fed to a processor, produces a requirement specification and a set of diagnostic reports concerning the consistency and organization of the specifications provided. [Ref. 21]

The problem with currently available manual and automated systems is the necessity of the user to learn some technical features to use the tool. An argument against these techniques is that the end-user should not be burdened with learning about the data processing field. Thus, some would argue it's beneficial to have the user interact only with that which will become specifications for, if not part of, the eventual system. A categorization of tools for prototyping has been made and offers a means of examining

what is available for use. The basic requirement for any of these items is that they can be used for prototyping if they allow designers and programmers to create a working system in a short period of time.

The first category of tools is data manipulation systems or data base management systems which can interface with a nonprocedural language to do data manipulation rather than just screen presentation. Such products as RAMIS, FOCUS and NOMAD are examples of this categorgy of tool [Ref. 22]. Also in this category are relational data base management systems which some feel are particularly suited for prototyping.

Relational data base management systems offer a high level of ease of use and data independence, both of which are advantageous for prototype development. The ease of use comes from the simple table data structures and the query languages associated with most relational systems. Data independence permits simple changes to logical or physical design without affecting existing programs [Ref. 23]. Relational data base management systems in this instance are being used as applications generators. Other examples of applications generators are report generators, graphics packages, statistical packages and software for screen layout. These items work at a higher level than another category of prototyping tool, program generators.

Program generators are software packages which, when given specifications, produce source listings, usually in a high order language such as COBCL, capable of being compiled and executed. Although not specifically oriented in the requirements definition area, they do provide assistance to requirements definition if it is necessary for the prototype to do actual data processing These are particularly helpful to programmers who must enhance the prototype into a production system. Such program generators are not in

proliferation at the current time, but a sufficient number exists to make them usable in some development efforts.

Another category of prototyping tool is libraries of reusable code. If a library of previously written routines, especially screens, exists which can be readily implemented to demonstrate a system's limited capabilities then the prototyper can easily pick and choose. This saves considerable effort and speeds along the process. However, such a library must be well organized so that the individual building the prototype can readily identify modules which suit his needs and can move these modules into the developing prototype with relative speed. This implies the code used has been well documented and generalized to be applicable beyond its original intent. The prototyper must be able to maintain momentum with users and this will not happen if he must stop to develop a detailed program. [Ref. 24]

Hardware as well as software should be considered in developing prototypes. The use of a microprocessor offers some unique benefits as a prototyping tool. A micro can be beneficial because it offers a cheaper alternative when considering the cost of acquiring a fourth generation language or a data base management system for a mainframe. A micro is portable and therefore can be taken to a user's area where currently no terminals exist. The micro can be left for the users to play with and discuss at their convenience without the possible dampening result of having a data processing person around. This way the end users are not imposed on by disruptive interviews. Finally, having to actually implement the features provides system builders better understanding of what the user wants and avoids the situation of just adding verbiage to a requirements specification. [Ref. 25]

F. DATA DRIVEN PROTOTYPING

There exists a categorization of prototyping techniques which divides all efforts into 1 of 2 possibilities. The first category is termed applications-oriented and describes the situation when the focus is on transaction modeling and simulation technology. Most people who belong to this school believe prototypes should be thrown away rather than carried forward and evolved. The other school, the data driven category, believes prototypes should evolve, extending the architecture of the business in a process akin to learning.

The thought is that requirements analysis should be an open system which learns from its experiences. It holds that freezing requirements makes for a closed system. A closed system is not responsive to the user and therefore doesn't reflect those desires which will make the system usable.

The data driven prototyping technique was created around an abstraction approach. The analysts and users should abstract from an entity base rather than decomposing from a functional base. The data driven school of thought contends that functional decomposition is not realistic because its use erroneously assumes requirements can be precisely determined before system construction is attempted. The prototyping approach is considered valid because it operates on the more realistic assumption that precise requirements are not always definable until after construction is started. Some argue that the top down design techniques, another way of referring to functional decomposition, are imperative in nature; that is, they force us to concentrate on the operations in the solution space, with little regard for discerning data structures.

The major difference between application and data driven prototyping is that the latter emphasizes a dominant role and value for data. Data prototypers believe entities are the essential elements of learning and that they transcend individual system boundaries. The data driven school contends that functional decomposition is not realistic because its use erroneously assumes requirements can be precisely determined before system construction is attempted.

The prototyping approach is considered valid because it operates on the more realistic assumption that precise requirements are not always definable until after construction is started. They assert that there is a data life cycle distinct from the traditional systems life cycle. Further, they believe the degree of integration of systems is a function of how much data are shared by the systems. From these concepts it is the job of the prototyper to discover and manage the integrating data in the most efficient and least expensive manner. The purpose of the data driven approach is to develop and maintain shared data bases (open systems) that are constantly being extended to accommodate new information requirements. The data bases should facilitate the extraction and synthesis of data into useful information from a static set of data structures.

Several steps are required to apply the data driven approach to a particular problem.

1. Operational reviews are conducted to evaluate the "as is" environment.
2. Conceptual design is conducted to define the metadata structure at the center of what will evolve. Scenarios are built in this step to describe those functions for changing or retrieving the metadata.
3. The metadata is normalized in the data design phase where the physical organization of the data is built.

4. Heuristic analysis then follows where requirement scenarios are exercised against the metadata structures using real data values.
5. Environmental testing is conducted where programs are built to support data acquisition and population of the data bases.
6. Quality control is applied via use of performance modeling to ensure the system not only reflects the user's desires but is processing in a realistic fashion.

Proceeding through these steps requires several tools such as items for information modeling, activity modeling, project control, a relational data base management system and a data dictionary. [Ref. 26]

G. RELATION BETWEEN PROTOTYPING AND DATA DICTIONARIES

The increasing complexity of computer systems and the growing demand of management that computer systems justify their cost and support decision-making calls for an integrated tool that is capable of recording and processing information. This information describes both the structure and usage of all the enterprise's data and functions. A data dictionary is a tool that, if integrated with prototyping and the traditional methodologies, can meet the demands of complex systems and management [Ref. 27]. Prototyping has proven so successful that some computer service companies have been developing packages to provide prototyping off the shelf. Most of these packages assume the existence of a fully descriptive data dictionary or else require the establishment of one [Ref. 28]. Some feel that the eventuality of extensive networking and distributed processing coupled with failure to properly elicit needs makes it imperative that data dictionaries be integrated into requirements analysis efforts [Ref. 29].

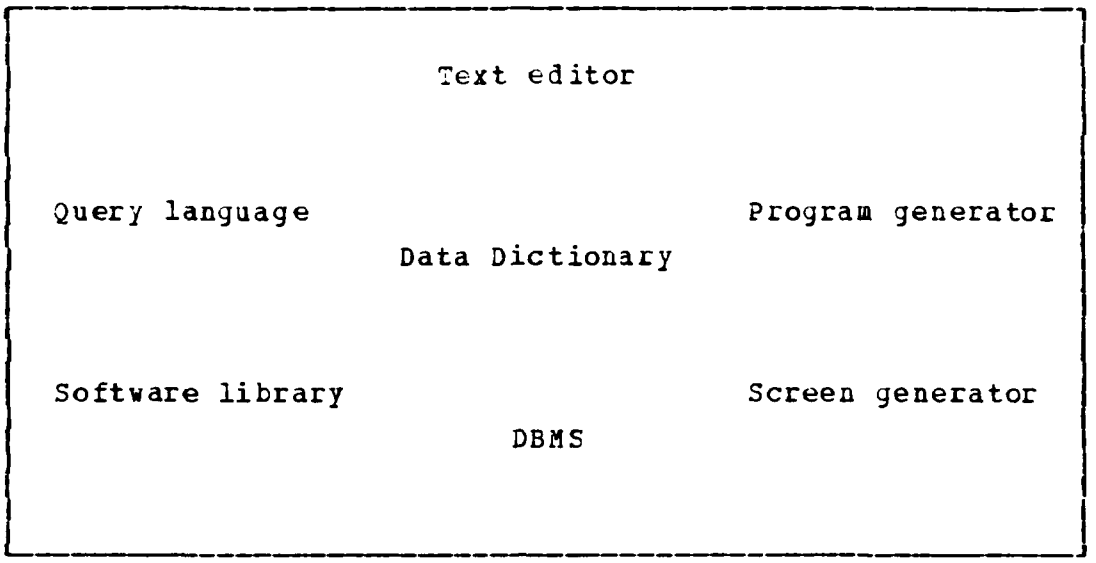


Figure 2.3 Integrating Function of A Data Dictionary

The data dictionary that results from requirements analysis can be a two-edged sword. It can become both a source and receptacle for the prototyping effort. Without a data dictionary of some type, preferably one that can be used as an adjunct to a software library, the analysis task is impossible. The dictionary can be used as a source of information necessary for prototyping since it can define entities, attributes and relationships at a conceptual level. A data dictionary can contain the output of prototyping in an organized, easy to manipulate database instead of using an unwieldy written document [Ref. 30]. In essence, a data dictionary should be at the center of the effort and serve to integrate all the conceptual output produced by the tools being used.

III. DATA DICTIONARIES

A. DATA CENTERED SYSTEM ANALYSIS

An understanding of the role data dictionaries play in software prototyping first requires an understanding of the underlying philosophy regarding their use. This philosophy is a data centered view of system analysis as opposed to a process centered approach.

Data centered system analysis treats the data as a separate resource. Processes are still considered important, but the target of all processing activity is data. An aspect of this approach is a perception of data processing as a succession of changes to data. A process is viewed as a series of data changes. The data centered approach contends that, in the long run, designing a stable, well-documented and largely non-redundant structure of data provides a simpler and cleaner form of data processing than embedding separately designed data structures into many different processes or applications programs.

Several advantages accrue from the data centered approach. The data centered approach helps avoid problems with file proliferation, maintenance, data redundacy and data inconsistency. Once the appropriate data bases are in place, some types of applications can be created quickly with high level data base languages. Individual users having direct access to the data bases can often create their own reports and applications, thus avoiding the slow steps of formal system analysis. Assembling data in different ways from the current inventory is not possible without a data dictionary. Data administrators, programmers and users cannot realistically be expected to have

sufficient knowledge of the logical organization of data bases to readily pick and choose data as needed to derive applications.

There are distinct disadvantages to the data centered approach. The data bases used must be well designed, yet the technology of good data base design is often not understood. The data centered approach implies the sharing of data which requires different management from that applied to a collection of separate files. There are conversion problems in moving from the traditional process centered to the data centered approach. Some of these are human behavioral problems caused by users losing control of data they previously "owned". The cost of conversion to a data base environment can be enormously expensive. The data centered approach is often more difficult to manage in its early phases, because of pressures to adopt quick alternate solutions or to maintain the status quo. Once set up, however, the data centered approach is easier to manage than a process centered one. Management must understand these issues clearly for the approach to work.

A key to controlling data bases and facilitating quick development is a data dictionary. A data dictionary can function as a tool, but tools should not get in the way of the primary goal: solving the problem. Any tool used for requirements analysis must contribute to managing project complexity rather impeding progress. Capturing the data which desribes the data held in the database, the metadata, must be a smooth, easy process which does not burden the momentum of discovery built in working with users. Users know what they do and therefore can describe processes far easier than data. Metadata is the essence of the means of achieving high productivity, shared databases and reduction of the inefficiencies associated with the traditional development process. [Ref. 31]

B. METADATA

Metadata is the term applied to that data which describes other data or databases. Metadata include descriptions of the meaning of data items, the ways in which the data are used; the sources of particular data elements; the physical characteristics; and rules or restrictions on their forms or uses. Some choose to classify metadata elements into 3 types: semantic, physical characteristic, or usage information. [Ref. 32]

Semantic information is comprised of the names of the component or entities. A unique identifier should be assigned to each component even though it may be known by other names. These other names are called aliases. The documenting and tracking of aliases promotes data sharing across applications. The prevalence of aliases should not be encouraged or discouraged, but should be accepted as a fact of life. End-users call things by different names and a data dictionary, as an adjunct to the database which models the real world, should accommodate that fact.

Physical characteristics are those items or information which describe the system dependent representation of the component. The length in bytes of a data element, or the access method for a particular file are examples of physical characteristics. This category includes relationships among systems and programs which use the database. That a particular data element may be found in records x, y and z and is referred to by programs A and B is an example of physical characteristic metadata.

Usage information illuminates how and by whom data are used. This type of information enables the database administrator to trace the source of errors. The existence of usage information also permits the database administrator to assess the impact of changes on the database and helps to

develop structures to monitor and control access. If the scope of a data dictionary is widened to include usage information then it must include data about users and processes as well as data about data elements. Processes can be performed by individuals, organizations, programs or entire systems. A process can be a single transaction, the generation of a particular item such as a report, or a broad function such as production of the entire monthly payroll to include checks, vouchers and a summary report for management. In compiling usage information, responsibility for a database related task should be assigned to a particular process to enable monitoring and correction. The source of a transaction, such as entering the number of hours worked for a payroll application, should be documented and traceable. In this example, a clerk may be used to verify and enter the number of hours worked. [Ref. 33]

Metadata can also be classified as one of three types of entities. Entities are either "real world" objects or concepts such as customers, acccunts, salespersons and orders. Metaentities can be classified as metadata entities, metasystem entities and meta-environment entities. [Ref. 34]

Entities which represent data objects, such as data elements, groups, records, files, databases or reports are examples of metadata entities. An element is a simple single item and is a "primitive", that is, it cannot be further divided. Elements can be accumulated, usually logically, to form other higher level metadata entities such as groups or records. A savings account number is an example of a data element. A data element can be recursive, meaning it can be formed or conceived as consisting of other data elements, yet for purposes of the particular application cannot be further subdivided. A savings account number may be separated by hyphens when printed and the

separated parts can represent different meanings, such as branch, type account, and specific customer. However, these different numbers will always be carried together as a singular item. [Ref. 35]

Two or more data elements can be collected into what is called a group. Groups can contain other groups. The elements or groups collected to form a group are usually logically related in some fashion. Thus, in the example of an address group the elements street, city, state and zip code are the logically related elements comprising the group. Groups are aggregations larger than an element but smaller than a record.

A record is a collection of one or more related data elements or groups that is treated as a logical unit. Each employee of a company, for example, would have one record and it would be a collection of these data elements and groups: name, department, employee number, age and home address. [Ref. 36]

A file is a set of occurrences of records treated as a unit. Different types of records may be contained within a single file, or it can contain many occurrences of a single type. An occurrence is where actual values have been assigned to the fields or data elements of a record, and the record therefore now models the reality of the entity on which it is based. [Ref. 37]

A database is an aggregation of DBMS files, records, groups and elements. Databases vary in both logical and physical organization depending on the data model used to design the database and the DBMS used to implement the database. [Ref. 38]

Reports are also classified as metadata entities although, unlike any of the previously discussed entities, reports are usually not stored but produced on execution of a subsystem or program. A report is a formatted

representation of information, not data. Data is manipulated and given meaning when a report is produced. Data items are facts which, without manipulation and association with other facts, have no meaning to humans.

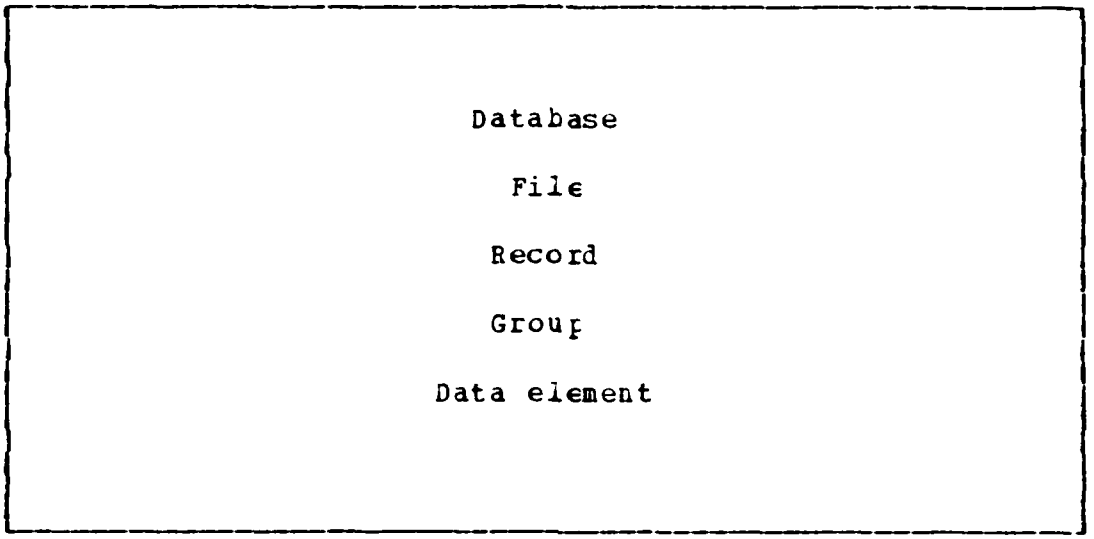


Figure 3.1 Hierarchy of Metadata Entities

Systems, programs, subroutines, and modules are all examples of metasystem entities. This class of metaentities represents processes of the data processing environment. [Ref. 39]

A system is a collection of related programs or systems which together perform a set of functions for some general purpose. For example, a payroll system might consist of many programs: one for producing checks, one for updating an employee database, and one for producing a summary report.

A program is a collection of source code statements (in assembly, compiler, query or fourth generation language) that accomplishes one or more actions. Programs contain one or more modules.

A module is a collection of executable statements which exists to accomplish one specific application function. Modules are the result of software being divided into separately addressable collections of source language statements. Modules can be categorized in one of three ways [Ref. 40] :

1. Sequential types which are referenced and executed without interruption of the application software.
2. Incremental types which can be interrupted before completion and restarted at the point of interruption.
3. Parallel types which execute simultaneously with another module in a multiprocessor environment.

A transaction is any event that requires the database information to be accessed. Transactions are characterized by type (batch or on-line), frequency (i.e. number of times per month), and use (add, delete, modify). Transactions are usually thought of as manual actions taken by a user which result in actions being taken by the software system.

Interfaces are places at which independent modules, programs, or systems meet and either act on or communicate with each other. Interfaces can be hardware, software, human or procedural components of a system. Most often there is a transfer of data across an interface which must be clearly understood. An interface description should provide a list of all data that enters and exits a component. For a single module the description should indicate what data moves across an argument list, any external world input/output information that is used and information acquired from global data items. An example of an interface description for a module which calculates the miles per gallon being used by a digital automobile dashboard system would look as follows [Ref. 41] :

Calling protocol: CALL CALC-MPG(MPH,GPH,MPG)

where

MPH is miles per gallon (real,input)
GPH is gallons per hour (real, input)
MPG is miles per gallon (real, output)

No external I/O or global data are used
CALLED BY: DATA-CONV-CTL
CALLS: no subordinates

The environment constitutes another category of meta-entities. This category can be divided into many different items if it is desired that the system track the equipment configuration as well as the data. If not, then the category of physical devices is sufficiently descriptive and refers to such items as a CRT terminal, printer, disk drive, etc. [Ref. 42]

An important aspect of gathering and analyzing metadata is describing it. Descriptive adjectives, categories and properties of an entity are called attributes. Plagman and Leong-Heong cite eight generic categories of meta-entity attributes:

1. Identification attributes which designate, describe or somehow identify the entity. Entities may be known by more than one name depending on the time, place and user's frame of reference.
2. Relationship attributes denote associations between two meta-entities. For example, one entity may be used by another. Relationship attributes are sometimes similar to interfaces. A link, subroutine call, access path or mapping qualify as a relationship type attribute.
3. Representation attributes describe an entity as it is implemented. A data element is represented in terms of character (alphabetic, numeric or mixed), source, or length.

4. Statistical attributes are numerical descriptions such as frequency, estimated life, and usage. This class of attributes are useful to the Database Administrator in assessing the impact of changes and for optimizing queries.
5. Physical attributes help describe environmental and system entities. Examples are storage media, storage size, terminals and CPU model.
6. User-defined attributes are those things about a particular application such as the users, analysts, designers, customers, etc. that are helpful. A "free-form" attribute is included in this category. This is often implemented as a comment field but can be specifically named if the user desires.
7. Control attributes are descriptors for how restraint over an entity is exercised such as security classification or edit criteria.
8. Status attributes provide the life cycle status of the entity; e.g. candidate, test, operational, deleted or archived [Ref. 43].
   a) A test status means the entity can be modified with approval of someone in project management. A test entity is not for production runs or general use.
   b) An item categorized as operational is being used by the system on a regular basis. Modification of the item, especially in a file oriented (as opposed to a DBMS oriented) environment, may cause problems and therefore is carefully controlled.
   c) Archived means the item is no longer used operationally anywhere in the automated components of the system. "Old timers" may still refer to archived entities and, therefore, such items should be available for reference, but not for use.

TABLE I

The Grouping of Meta-Entities

DATA	SYSTEM/PROCESSING	ENVIRONMENTAL
Element	System	Physical Devices
Record	Subsystem	Computer system
Group	Program	Terminal
File	Module	Line
Database	Transaction	Users
Screen		Node
Report		Function

Indicating the status of a meta-entity is important for the purposes of project and configuration management. It is important to know whether a simple data element, a program or an entire system is either under development, being integrated or operational.

It is obvious from this discussion that the task of managing metadata can be as challenging as managing the user's data. Consequently, the same techniques can be used to manage metadata, that is, organizing it into a database, the data dictionary.

C. DEFINITION AND OBJECTIVES OF A DATA DICTIONARY

Familiarity with what constitutes a data dictionary and the purpose for having one are requisite for later understanding of its role in requirements analysis. The need for documenting data is obvious and grows from the universally recognized need to document the two primary components of any software system, functions and data. A data dictionary is a repository of data about data and processes associated with a particular systems development effort. A dictionary often includes a glossary of terms, data characteristics, process descriptions, and some cross-referencing mechanism.

Data dictionaries come in three different forms.

1. The data documentation for a system can be made a part of either the requirements specification or a design document.
2. A data dictionary can exist as a separate printed document.
3. A data dictionary can be an automated data base.

Data dictionaries can be expanded to include information about the physical location of the data. In that case it becomes a data dictionary/directory. If either the data dictionary or data dictionary/directory uses software to store and access the data, it is considered a system. The following delineates feasible manifestations of a dictionary:

1. A data dictionary is a repository for data about data and functions.
2. A data dictionary system is a software system to store and access data about data and functions.
3. A data dictionary/directory is a repository about both logical and physical information for data and functions.

4. A data dictionary/directory system is a software system to store and access both logical and physical information about data and functions.

Several criteria are worth examining in deciding which way to document data. These are:

1. Estimated size and complexity of the system.
2. Extent of sharing of data between systems.
3. Use of a generalized DBMS.
4. Availability of automated data dictionary software.
5. Number of data descriptions.
6. Complexity of data structures.
7. Volatility of data descriptions.
8. Number of analysts and programmers involved.
9. Number of organizations involved.
10. Amount of clerical assistance available.
11. Uses of the data documentation.

The greater the number and strength of these factors, the earlier a decision must be made about which means to document data, and the stronger the probability that that means will be an automated system. Regardless of form a data dictionary should document several different components.

All files, record types, items within records and pertinent information about the use of the data should be included in the data dictionary. Pertinent information includes such items as physical description, logical description, and functional description of how the data is used. Further, it elaborates on how the data is changed, how it is removed, and how integrity is ensured.

Based on the information the dictionary holds, it may satisfy many objectives [Ref. 44]. Generally any data dictionary should provide facilities and formats for documenting the information collected during all stages; analysis, design and implementation. Further, it should

help the analysts follow any of the structured methodologies available for system development. Data descriptions, not only processes, should be traceable back through program functions to the original statement of requirements. The dictionary should be readily extensible to accommodate growth or expanded application. Its existence should help achieve the establishment of a glossary of terms and thus provide for standard terminology. Analysis can be accomplished using the proper terms in the proper context in dealing with the user's particular application area. Semantics are important for both understanding the user's area and for tailoring the system to his frame of reference. Modules which are available to all systems should be identified via a generic cross-reference capability.

Going beyond the analysis phase, the dictionary can provide assistance in generating manageable and complete test data. Problems which arise associated with aliases and acronyms can be resolved via a data dictionary. As an adjunct to configuration management, a dictionary provides centralized control for system changes. Again going beyond the analysis phase, a dictionary can serve as a reference and guide in training users and for design evolution. Maintenance efforts can be assisted in a similar vein in that programmers unfamiliar with specifics can refer to the dictionary as a guide.

Having met a majority of these objectives, a dictionary should be capable of answering several questions [Ref. 45], [Ref. 46].

1. What kind of validity tests have been applied to this data type?
2. Who is authorized to update this data item?
3. What modules, programs or systems use this data type?
4. What are the valid ranges of values for this data? (domain)

5. What security level is applied to this item?
6. Who is allowed access to the data?
7. By what other names is the data type known in various application environments? (the differences should be minimized)
8. In what reports does this data type appear?
9. What is the input source for this data type?
10. What are all the data items used by a given program or report?

Data dictionaries may have problems, particularly if they are not well organized. If a dictionary is fully used, meaning that if it is an active dictionary which serves a controlling function, then it becomes a centralized controlling facility. Centralized control of data is not always desirarable or appropriate. For a data dictionary to get to this point, considerable effort must be expended. Therein lies another problem in that development and implementation, to be useful, requires careful thought and considerable effort [Ref. 47]. Another problem is the lack of a methodology which ties the use of a dictionary into the overall system development effort. Dictionaries need to be able to support and measure the documentation progress. Unfortunately the means of describing primitive entities in different commercial data dictionary packages is dissimilar. Few dictionaries have specific provisions for supporting a structured analysis technique [Ref. 48]. Features which are important for database design, but absent from many current products are support for distinguishing between a data element and its domain and the lack of a graphic representation capability. In response to these problems this thesis proposes that a model that is easily understood, the relational, be used to organize a data dictionary.

The relational model is appropriate for protoyping with data dictionaries for several reasons. As discussed earlier, the ease of use, availability of query language and data independence make relational-based DBMS good tools for prototyping. The relational model is good for data dictionary implementation because many relational DBMS have a "triggering" mechanism causing a program to be invoked on some data event or condition. This is an essential feature for a data dictionary to be active, that is, to serve as a monitor of database activity to ensure data integrity. An additional advantage is the schemas of relational systems are tables. This can reduce the work required to implement the dictionary system. For these reasons, and because relational DBMS are now available for microcomputers, a prototype data dictionary has been developed and is described in the next chapter.

IV. A DATA DICTIONARY BASED ON THE RELATIONAL MODEL

A. INTRODUCTION

The office of the Deputy Chief of Staff for Plans (DCSPLANS), the US Army Military Personnel Center (MILPERCEN), has the responsibility to develop and maintain computer based modelling capabilities to support personnel policy development for the Army. DCSPLANS has subordinate branches each of which uses and/or maintains models. In a prototype effort to assist DCSPLANS organize and account for these information resources, a relational dictionary system was developed using the dBase II relational DBMS.

The prototype system is capable of running on an IBM Personal Computer. A relational based DBMS was used because of the features previously discussed. A microcomputer-based version was used to facilitate transfer of the prototype from the development site at the Naval Postgraduate School to MILPERCEN at Alexandria, VA.

The dictionary accounts for several different relations including reports, offices, models, programs, files, elements (which are partitions of files, rather than data elements) and fields. The generalized format of these relations is as follows:

REPORT(rname, full_name, number, status, sec_class, output_format, purpose, description, perdiodicity)

OFFICE(ofc, oname, bldg, room, phone, comments, poc)

MODEL(mdl, model_name, methodology, status, location, purpose, description, runame, perdiodicity)

PROGRAM(pname, version, location, language, purpose, description, status, perdiodicity)

FILE(fname, full_name, last_update, media, status, sec_class, purpose, description, poc)

ELEMENT(elname, version, date, seq_num, size, poc, purpose, location)

FIELD(fld, length, data_type, null_status, source, domain, description, purpose, status, sec_class, poc)

For a detailed explanation of the attributes for these relations, see Appendix B, Data Dictionary Data Elements.

Relationships amongst the various relations are tracked by having relations with a verb name reflecting how one entity relates to another. For example, since a MODEL may be used by many different OFFICES, a USES relation is included in the dictionary. Its format is as follows:

USES(ofc, ename, etype). An example occurrence of this relation would be:

USES(DAPC-PLF, P3M, MODEL)

which states that the office DAPC-PLF uses the P3M model.

There are six of these verb type relations. In addition to the USES relation these are CONTAINS, MAINTAINS, OUTPUTS, INPUTS, and CALLS. The generalized format of each of these is as follows:

CONTAINS(ename1, etype1, ename, etype)

MAINTAINS(ofc, mdl, model_poc)

OUTPUTS(ename1, etype1, ename, etype)

INPUTS(ename1, etype1, ename, etype)

CALLS(ename1, etype1, ename, etype)

The attribute ename stands for entity name and the attribute entity type stands for entity type. In general, these attributes can be instantiated by any entity (e.g. model, program, file, element, etc.) The specific relationships these relations track (see Figure 4.1) are as follows:

1. An OFFICE uses many different REPORTS.
2. An OFFICE uses or maintains many MODELS.
3. A MODEL is used or maintained by many different OFFICES.
4. A MODEL calls many different PROGRAMS.
5. A MODEL outputs many different FILES.
6. A MODEL inputs many different FILES, i.e. requires many different FILES as inputs.
7. A MODEL outputs many different REPORTS.
8. A FILE contains many different ELEMENTS.
9. An ELEMENT contains many different FIELDS.
10. A FIELD is contained by many different ELEMENTS.

There are two special relations which are neither pure entities nor verb descriptors. These are ALIAS and CATEGORY.

The ALIAS relation provides a means of tracking entities by all known names. Often an entity is given one or more names other than that by which it's officially known. For the users the other name, the alias, is the natural way of referring to the entity and therefore the dictionary should accomodate that. The Personnel Policy Projection Model being called "Pimmy" is an example of an alias.

The CATEGORY relation provides the basis for Key Word In Context (KWIC) capability. Further, it allows the user to categorize different types of entities and relate them in an ad-hoc fashion. For example, if several files and programs were the responsibility of a particular programmer to audit, all those different entities could be entered as category records with that programmer's name as the particular category.

The format of the ALIAS and CATEGORY relations is as follows:

ALIAS(ename, etype, aname)

CATEGORY(ename, etype, cat)

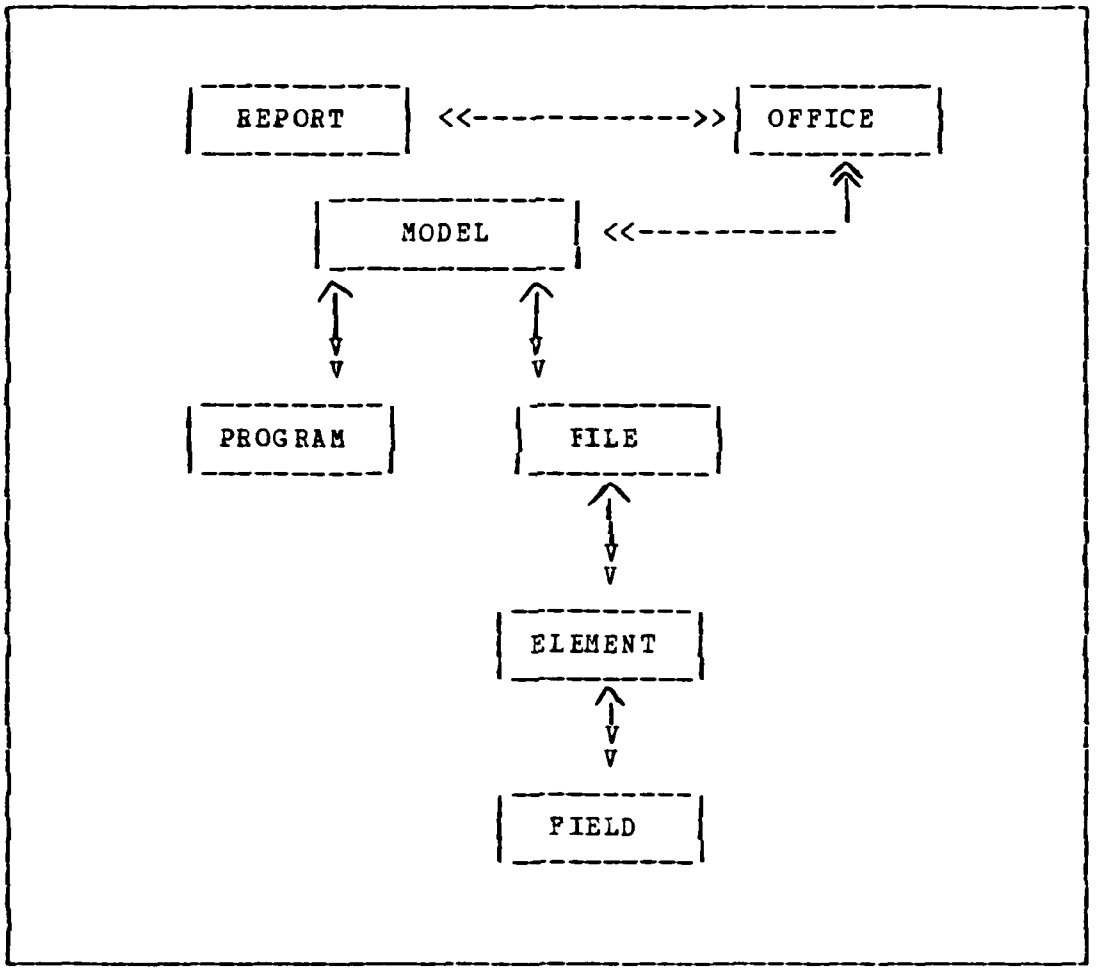


Figure 4.1 Bachman Diagram of Entities

Structuring the metadata as shown above offers advantages for ease of learning and using the data dictionary. The logical structure is based on a

commercially successful data dictionary system, DataManager. The data dictionary is a database and therefore models the real world in a limited fashion. By taking a data-centered viewpoint wherein all entities are categorized as either objects (i.e. models or reports), or processes (i.e. uses, contains, maintains) which act on objects, an easy-to-understand model emerges. Consequently, use of the dictionary is facilitated so that it becomes a tool, rather than a burden to the data system developer/maintainer/user. This will be substantiated by the following discussion of the system structure and query/report capabilities.

B. SYSTEM STRUCTURE AND USER INTERFACE

The software of the system was structured to provide all the possible functions one might wish in a database system. These are the ability to add, change, or delete records and to provide reports and queries (see Figure 4.2). Because the system is a prototype and specific user needs are unknown, all functions are provided. Depending on user feedback and observations made by the analyst, these functions can be expanded to offer different dialogues or be converted to batch procedures.

The user interface for any interactive system is an important criterion for success. Because a data dictionary system should be a tool to facilitate software system development and maintenance, it should provide a friendly user interface. This data dictionary system is menu and prompt driven. The software prompts for all necessary data and actions to develop and maintain intersection records (in this system called processes or verbal relations such as CONTAINS or USES). Consequently the user manual for the system is not a long and trying document to use.

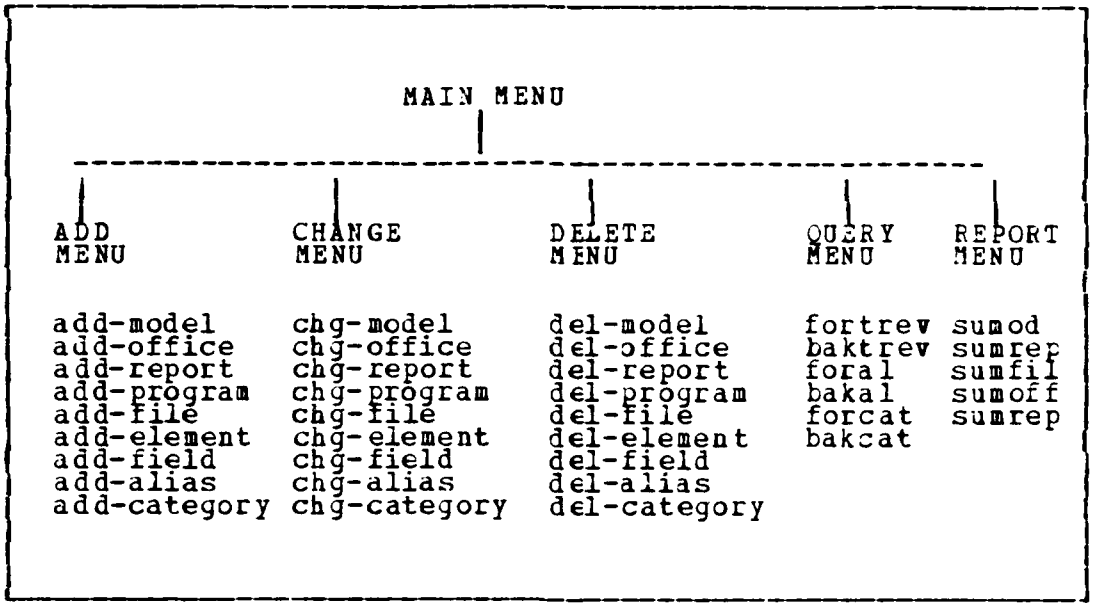


Figure 4.2 Hierarchical Chart of Software

The query interface is particularly friendly. The system, named dDICT II, provides two types of queries, forward and backward. Forward means the user is presented columns of relations from which to pick. The columns, following the forward flow of the English language, are subject, verb and objects. The user provides the unique name of an entity beside its type in the subject column; marks 1 appropriate verb column and 1 appropriate object column. For example, to answer the question "What models does the office with symbol DAPC-PLF use ?" the Figure 4.3 depicts how the screen of the FORTREV program would appear. The Figure 4.4 depicts how output from this query would appear. Verb and object choices must be appropriate for the subject in that it is not possible to get any response from a query marked for which there is no relationship defined. For example, marking the screen of the FORTREV program to answer the question "What models contain what fields ? " would elicit no response when processed.

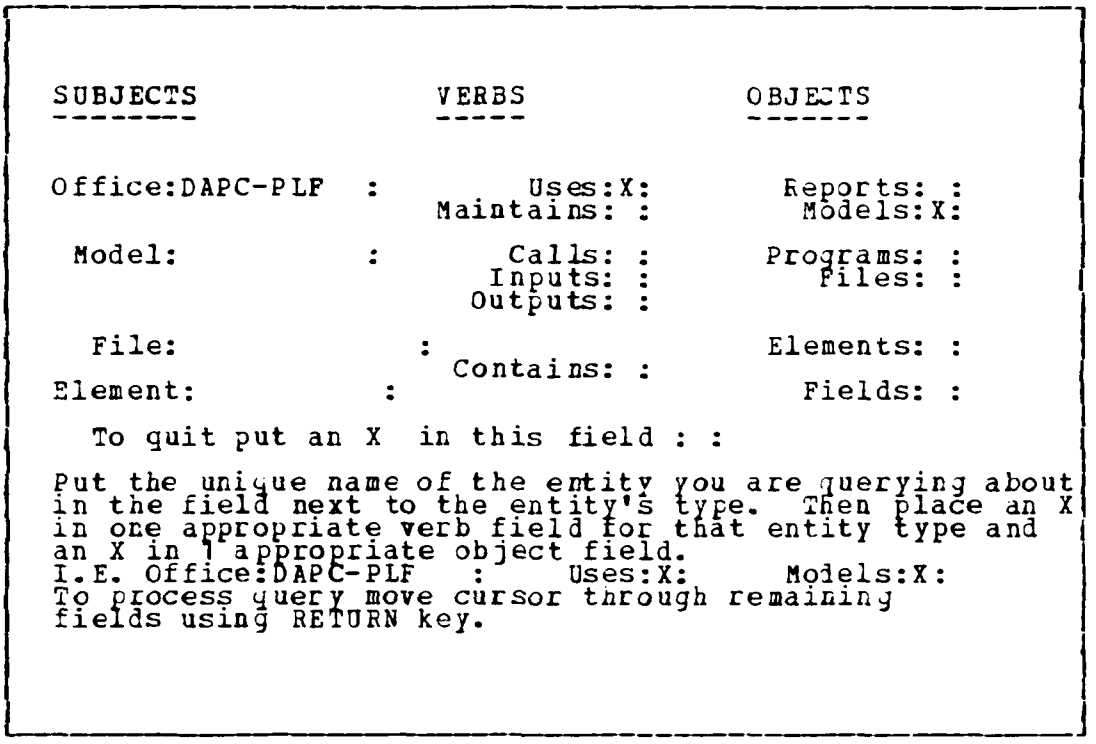


Figure 4.3 Example of a Forward Retrieval

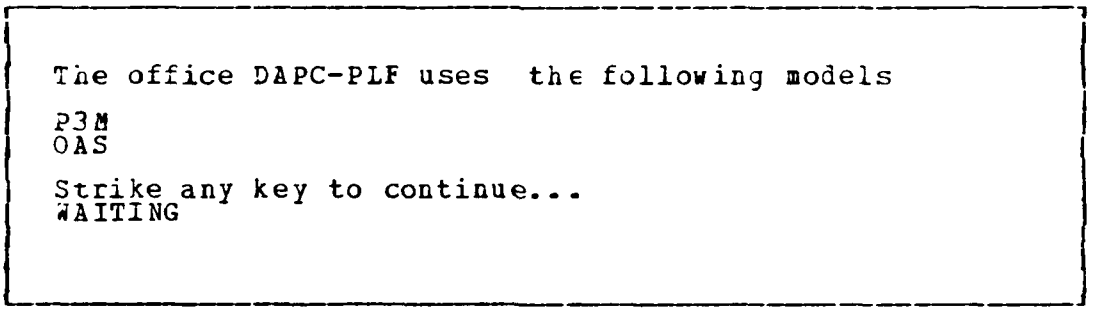


Figure 4.4 Sample Output From a Forward Retrieval

The backwards approach is implemented by presenting from left to right columns of objects, verbs and then subjects. Thus, to answer a question such as "What offices

use the P3M model ?" see Figure 4.5 for how the the screen of the BAKTREV program would be marked. This query will produce the unique names of the offices that use the P3M Model and Figure 4.6 shows how the output would appear.

```
OBJECTS              VERBS                SUBJECTS
-------              -----                --------

 Model:P3M     :          Is used by:X:        Office:X:
Report:        :   Is maintained by: :

Program:       :     Is called by: :          Model: :
File:          :   Is inputted by: :
                   Is outputted by: :

Element:       :                               File: :
                   Is contained in: :
   Field: :                                 Element: :

  To quit put an X in this field: :

Enter the name of the entity besides its type and then
mark 1 verb field and 1 subject field.  To process
query move cursor down through remaining fields
using RETURN key.
```

Figure 4.5 Example of a Backward Retrieval

Because the ALIAS and CATEGORY relations are each a special case, they are given their own respective forward (FORAL & FORCAT) and backward (BAKAL & BAKCAT) query programs. For example, if you wish to know all the aliases that exist for all models in dDICT II you would execute the FORAL program and mark the menu as in Figure 4.7 and Figure 4.8 shows how the output would appear.

If you wish to know all aliases for an entity for which you knew the name you would use the BAKAL query. For example, if you wanted to know all the aliases for the P3M

```
The model P3M       is used by the following offices

DAPC-PLP
DAPC-PLT
DAPC-PLS
DAPC-PLF

Strike any key to continue ...
WAITING
```

Figure 4.6 Output From a Backwards Retrieval

```
   Model:X:                File: :
 Program: :              Element: :
  Report: :                Field: :

Enter an X in the field beside the type of entity
for which you want all names and aliases. Mark only 1
field.
```

Figure 4.7 Example of FORAL Menu

model you would mark the menu of the BAKAL query as in Figure 4.9 and Figure 4.10 shows how the output from that query would appear.

The FORCAT program permits you to determine all occurrences of a type of entity and in what category each occurence falls. For example, if you wish to know what models had been categorized in some way see Figure 4.11 for how to mark the menu of the FORCAT program. Figure 4.12 depicts how the output would appear. See Figures 4.13 and 4.14 regarding use of the BAKCAT program.

```
The following models have the associated aliases

P3M         PIMMY
P3M         PAIN
OAS         ASSETER

Strike any key to continue ...
WAITING
```

Figure 4.8 Example of Output From FORAL Query

```
  Model:P3M      :              File:              :
Program:                :    Element:            :
 Report:           :           Field:              :

Enter the name of the entity in the field
beside its type.  Provide only 1 name.
```

Figure 4.9 Example of BAKAL Program

```
The model P3M      has the following aliases

PIMMY
PAIN

Strike any key to continue ...
WAITING
```

Figure 4.10 Example of Output from BAKAL

```
   Model:X:                    File: :
  Program: :                 Element: :
   Report: :                   Field: :
Enter an X in the field besides the type of
entity for which you want all names and associated
category. Mark only 1 field.
```

Figure 4.11 Example of Menu for FORCAT Program

```
The following models are in the associated category
OAS              OFFICER
Strike any key to continue ...
WAITING
```

Figure 4.12 Example of Output From FORCAT

For more extensive information about a particular Model, File, Office, or Report, the Report subsystem exists. This subsystem has a menu from which the user selects the type of report program to execute. The system will then prompt the user for the unique name of an entity. From that the system will then provide a printed summary report which provides all entities which have a direct relationship with the entity named. Thus, if the user provides the unique name of a Model, the printed report would list:

1. All offices which use the Model.

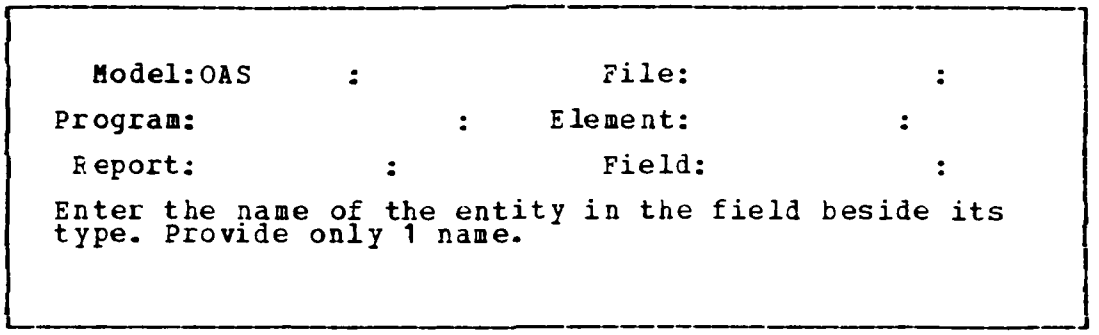


Figure 4.13 Example of Menu for BAKCAT Program

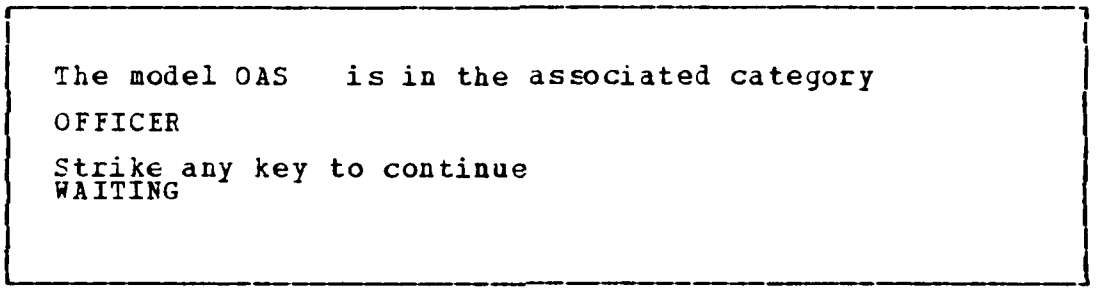


Figure 4.14 Example of Output for BAKCAT Program

2. All offices which maintain the Model.
3. All programs the Model calls.
4. All reports the Model outputs.
5. All files the Model either inputs from or outputs to.

For example, if you wished to have a summary report for the P3M model you would select option 1 from the Reports menu for execution of the SUMOD program. The system would then prompt you as follows:

Please enter the unique name of the Model
Hit the space bar and RETURN to quit:P3M

Figure 4.15 shows how the output would appear.

```
The Model  P3M
Is used by the following offices:

DAPC-PLP
DAPC-PLT
DAPC-PLS
DAPC-PLF

Is maintained by the following offices with
the point of contact:

DAPC-PLF  KALINICH

Inputs the following files:

P3MDATA

Outputs to the following files:

P3MOUTPUT1

Outputs the following reports:

 EPMR
 P3MREP1

Calls the following programs

P3MPROGUNO1
P3MPROGDOS1
P3MPRCGTRES1

Strike any key to continue
WAITING
```

Figure 4.15 Example of Report Output

Providing these query and report capabilites makes the dictionary more than a repository but a fully capable tool. Use of the dictionary to manage data is not merely made possible but truly facilitated. The data administrator can quickly input or retrieve metadata as appropriate to impose order, control and effective management of a critical part of the organization's resources. Implementation and use of a dictionary marks an important step in an organization towards knowing what data assets it has and most

importantly, what data assets it needs. Needs are requirements the specification of which must be precise to be implementable. For example, knowing exactly what fields occur in what elements and, therefore, what else we need to accomplish some function is a critical question to be answered in defining requirements. Having an automated and interactive means of answering such questions provides a decided advantage over using textual documents. This dictionary thus provides an important tool from which the data administrator can more expeditiously manage the organization's current data processing capabilities.

Because the user of this dictionary is located across the country from the development site, a demonstration version of the dictionary was created and populated with example data (see Figures 4.16 and 4.17). The demonstration version can be used to learn the capabilities of the system without fear of destroying anything. Once confident with the operation of the demonstration version, the user can migrate to the production version.

Because dDICT II is a prototype it is missing features a refined and full production system would have. Most importantly, the software doesn't enforce relational constraints. Thus, some entities can be present without others also being present. For example, a program can exist without there also existing a model which calls that program. It remains to be determined how important it is for metadata integrity to have the software enforce relational constraints. Further, dDICT II does not enforce what can be entered for a particular attribute of an entity. Because many of the attributes contain narrative text it is not possible to develop precise logic for what can and cannot be entered. However, this is a refinement which should be added once the user has migrated to the production version and populated it with real metadata. The attributes

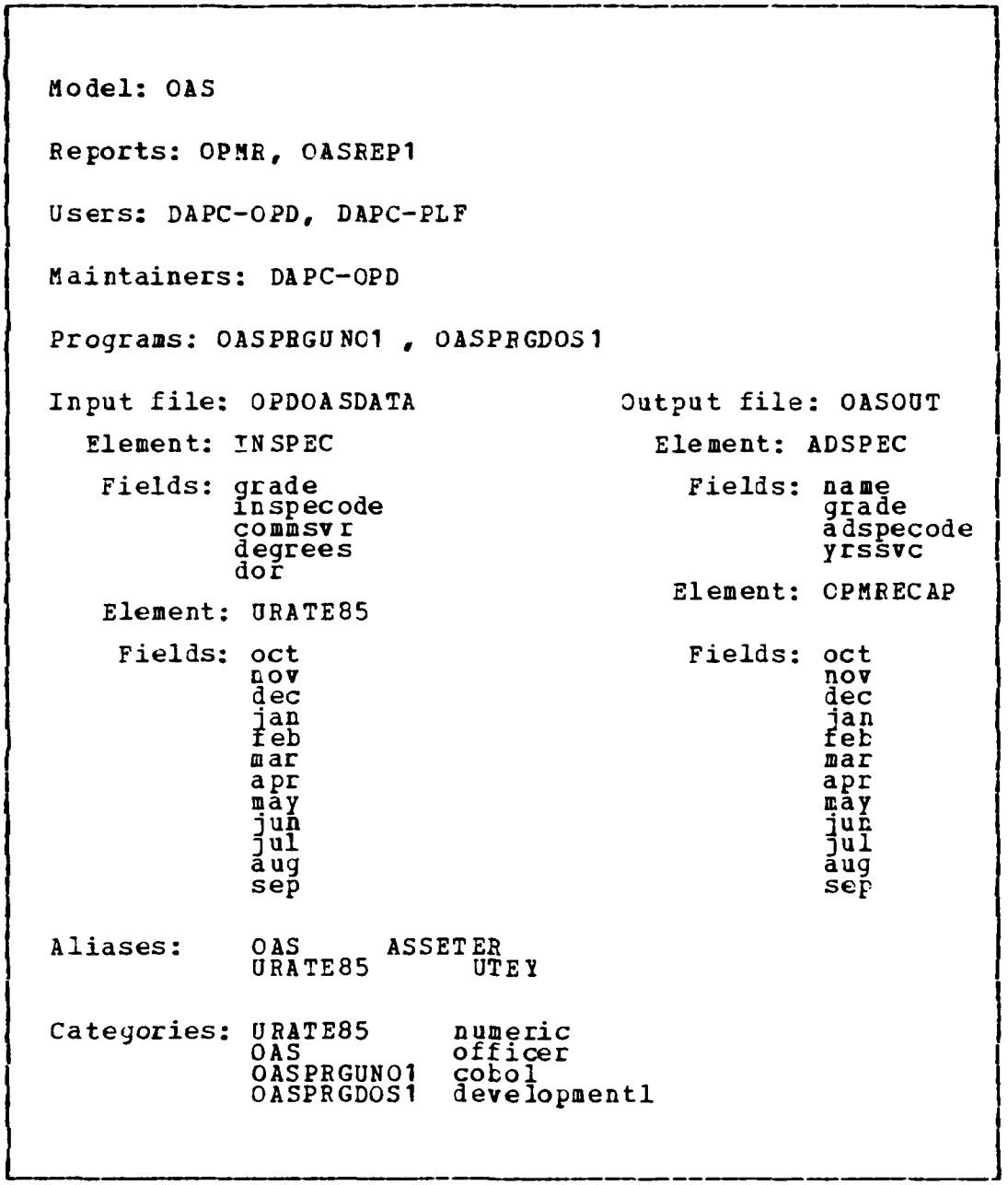


Figure 4.16 First Example of Demonstration Data

used in describing metadata entities lack precision and need tightening in follow-on efforts. Precise domains need be

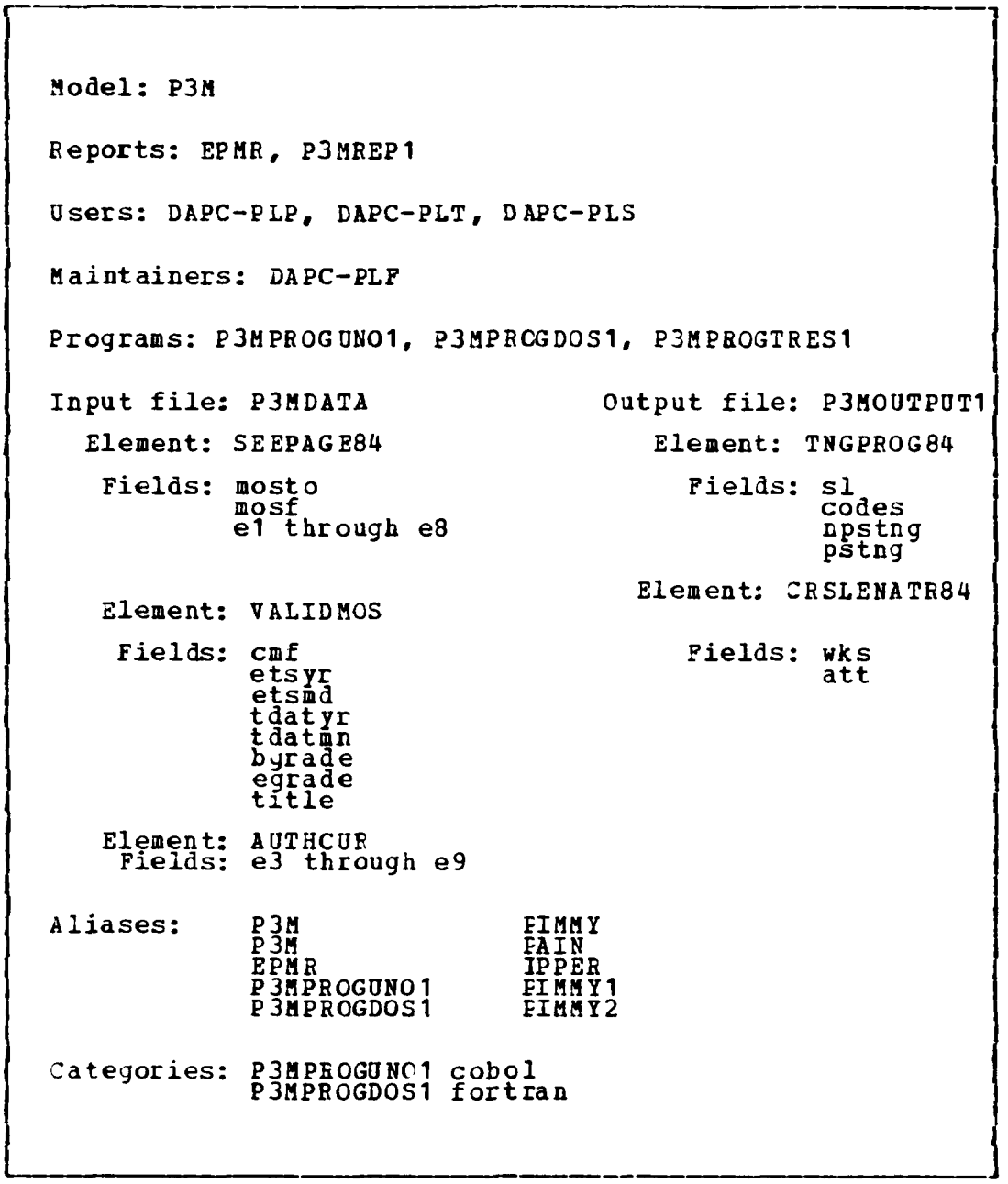


Figure 4.17 Second Example of Demonstration Data

determined, documented and enforced by edit criteria. Refining the user's specification of metadata will

facilitate more extensive query and report capabilities. It is only possible with more specific domains that a more user friendly query interface can be developed, possibly using artificial intelligence techniques. Using artificial intelligence techniques will lead to a more useful tool capable of assessing the impact of change on the databases through sensitivity analysis on the dictionary. Unfortunately, the prototype version is not "instrumented" to capture user peculiarities for enhancing friendliness and performance. Because dBASE II was used, the system suffers poor performance in comparison to what would be enjoyed using dBASE III. A full production version would be inordinately slow if not implemented in dBASE III.

V. CONCLUSIONS

This thesis has investigated the use of prototypes and data dictionaries as vehicles for assisting requirements analysis. It has explained the advantages and disadvantages of prototypes; provided guidance for their use; explained tools that are needed and provided a data driven approach to prototyping. It has shown that prototyping is a useful adjunct to the systems development life cycle and is most appropriately applied to Management Information System applications. The most significant contribution of prototyping is the establishment and maintenance of effective communications with the user during system development.

This thesis has shown the importance of having a data dictionary mechanism to capture the output of prototyping. Further, it has explained metadata and its importance in building a system and understanding both the user's requirements and project management's requirements. Clearly metadata, like user data, must be organized into a database, a data dictionary system. Organization of a data dictionary can be in accordance with one of many different data models, but the relational offers the most promise for future use. Consequently, the thesis includes a prototype relational dictionary system.

The dictionary system demonstrates the feasibility of using:

1. the relational model for a data dictionary.
2. micro-computers in a prototype effort.

Although of limited functionality, the prototype was quickly developed and offers considerable flexibility in its structure to serve as an on-going aid in developing the data

administration function in the user's organization. DDICT II is living proof of the viability of prototyping with data dictionaries as a means of organizing and understanding the data and user's needs in system development.

APPENDIX A
USER MANUAL

A. INTRODUCTION

This manual explains only what is necessary to get started using the system. The system is self-prompting and, therefore, an extended narrative is unnecessary. This manual explains the use of both the demonstration system and the actual dictionary. The demonstration system resides on floppy disks and requires a different initialization procedure. If you are using the demonstration system, proceed to the next section. If you want to use the actual installed dictionary, skip to section C. After initialization both systems operate identically so, upon completing initialization, proceed to section D, MAIN menu.

B. INITIALIZING THE DEMONSTRATION SYSTEM

1. If the system is on, turn it off and remove all floppy disks.
2. Insert the floppy disk marked 'dBASE II' into drive A and the floppy marked 'DEMONSTRATION' into drive B.
3. Turn on the system (all components: computer, monitor and printer).
4. Upon being prompted for the date, you may enter it in the general form: MM-DD-YY , or simply strike the RETURN key. The same is true for the following prompt for the time. If you wish to have the current time available to the system, the general form of your reply is: HH:MM .
5. Upon correctly answering the time and date prompts you will receive the following on the screen:

A>

6. Now type in 'DBASE' and hit the RETURN key.
7. You will hear the 'A' disk drive whirr and its light come on. After a few seconds a message will appear:

   Copyright (C) 1982 RSP Inc. *** dBASE II/86 Ver 2.4
   1 July 1983

   ._

   The blinking underline character following the period is the cursor. The period is the prompt used by dBASE II and indicates that you have accessed the dBASE II software.
8. You should now type the following in response to the prompt:

   SET DEFAULT TO B:

9. Upon receiving the period prompt you are now ready to use the demonstration version of the data dictionary. At this point proceed to section D, MAIN menu.

C. INITIALIZING THE INSTALLED DICTIONARY

This manual assumes that the user is familiar with the IBM PC sufficiently to start it up and move to the appropriate working directory upon which the dictionary system is installed. For the purpose of this manual it assumes that directory (disk drive) is C. Once you have moved to that disk you are ready to start up the dbase II software. At this point type in "dbase" and then hit the RETURN key. You will hear the "C" disk drive whirr and its light come on. After a few seconds a message that reads as follows will appear:

Copyright (C) 1982 RSP Inc. *** dBASE II/86 Ver 2.4 1 July 1983

.

The blinking underline character following the period is the cursor. The period is the prompt for dBASE II and indicates that you have the accessed dBASE II software. Upon receiving the period prompt you are now ready to use the actual version of the data dictionary. Proceed to the next section, MAIN menu.

D. MAIN MENU

Type in the following and the main menu for the data dictionary will appear: DO MAIN (all capital letters aren't necessary, but it's best for this particular system to set the "caps lock" key so that you are always in uppercase. To set the "caps lock" key just strike the key so marked once).

The MAIN menu permits selection of the major function you wish to perform. Upon selecting a major function, enter the number associated and another menu will appear. Please wait for the "WAITING" message to appear before typing the number of the major function you want. Upon selecting a major function another menu will appear (See example of the Main Menu on the next page). Use the instructions of this manual for working with those menus. After a period of use you will become familiar with the specific functions of the system, such as adding a model record. If you find the use of the menus tedious at that time, you can execute any specific program by entering "DC program name". For example, to directly execute the program to change an office record you would enter "DO CHG-OFFICE". To help you learn the specific program names they are provided in the menus in parentheses beside the explanation of a choice. This means that once you have the period prompt mentioned above, you

can directly accomplish a particular function by executing the associated program and not stepping through the menus.

This is the MAIN menu for the data dictionary system. The system allows you to add, change, or delete records and to process queries. Please enter the number of the function you wish to perform:

0 to quit

1 add a new record	(ADD-MENU)
2 change a record	(CHG-MENU)
3 delete a record	(DEL-MENU)
4 run a query	(QERY-MENU)
5 print a report	(REPT-MENU)

Enter the selection here
WAITING

E. ADD SUBSYSTEM

There are two methods of accessing the ADD-MENU; either by typing in the command 'DO ADD-MENU' or by selecting option #1 from the MAIN-MENU. In either case, the following menu will appear:

ADD MENU

0 to quit

1 Model (ADD-MODEL)	5 File (ADD-FI)
2 Office (ADD-OFFICE)	6 Element (ADD-EL)
3 Report (ADD-REP)	7 Field (ADD-FE)
4 Program (ADD-PRO)	8 Alias (ADD-AL)
	9 Category (ADD-CAT)

Enter the selection here
WAITING 0

Selecting 0 from the ADD-MENU will return you to either the MAIN-MENU or a blank screen (if the 'DO ADD-MENU' command was used).

To add a new record, press the number associated with the entity's type. The system will prompt you for the unique name of the entity you wish to add. If that name is not truly unique, the system will tell you so and not permit you to add a new record. If the name is unique a screen will appear with the fields highlighted to include blank spaces for entering data for the new record. Simply fill in the appropriate data items and move from field to field (USING THE CURSOR) until you have filled in all the blank fields for which you have data. Once you have assured yourself that all data items you have entered are correct, hit the RETURN key and the record will be added to the database. (Note: after the RETURN key has been hit changes can only be made using the CHANGE subsystem)

Once you have entered a record by hitting the RETURN key you will be prompted if you wish to add another record to the database. To stop adding records, hit the space bar and RETURN. As soon as the RETURN key is hit you will be returned to either the ADD-MENU or the dbase II system.

F. CHANGE SUBSYSTEM

There are two methods of accessing the CHANGE menu , either typing in the command "DC CHG-MENU" and striking the return key or selecting option 2 from MAIN menu. In either case the CHG menu will appear as follows:

This is the CHANGE menu. It permits you to change records in any file. Please enter the number of the function you wish to perform.

0 to quit

1 Model (CHG-MODEL) 5 File (CHG-FI)

2 Office (CHG-OFFICE)
3 Report (CHG-REP)
4 Program (CHG-PRO)
6 Element (CHG-EL)
7 Field (CHG-FE)
8 Alias (CHG-AL)
9 Category (CHG-CAT)

Enter the selection here
WAITING
When selecting from the menu always wait for the system to prompt you with the words "WAITING". Selecting 0 will return you to either the MAIN menu or a blank screen (if the "DO CHG-MENU" command was used).

Regardless of whatever type entity you wish to change, the system will require you to provide the entity's unique name. To quit changing records, hit the space bar and RETURN. The system will then find the record for that entity and present it on the screen for editing. Having completed the editing, the record can be stored back in the dictionary by moving the cursor down through the last field using the RETURN key. If there are any relationships for which the entity is an object of, the particular program you are using will prompt you if you wish to add or delete entities associated with the one you just changed. For example, if you edited the record for a particular FIELD, then the system will prompt you if you wish to add or delete verbal type records for ELEMENTS that contain the FIELD. A change in the unique name of an entity will be automatically changed in all verbal type records for you by the software. For example, if you changed the unique name of a FIELD the software will change all CONTAINS records accordingly for you.

G. DELETE SUBSYSTEM

There are two methods of accessing the DELETE menu , either typing in the command "DO DEL-MENU" and striking the return key or selecting option 3 from MAIN menu. In either case the DELETE menu will appear as follows:

This is the DELETE menu. It permits you to delete records from any file. Please enter the number of the function you wish to perform.

0 to quit

1 Model (DEL-MODEL)	5 File (DEL-FI)
2 Office (DEL-OFFICE)	6 Element (DEL-EL)
3 Report (DEL-REP)	7 Field (DEL-FE)
4 Program (DEL-PRC)	8 Alias (DEL-AL)
	9 Category (DEL-CAT)

Enter the selection here

WAITING

Select the type entity you wish to delete by entering the number associated with the entity's type. The particular program selected will prompt you for the unique name of the entity. To quit deleting records, hit the space bar and RETURN, otherwise type in the name and hit RETURN. If you have given the unique name correctly, the system will find that entity's record and ask if you are sure that is the one you wish to delete. If you answer Y, the system will delete the associated record, not merely mark it for deletion. Further, the system will automatically delete all associated verbal type records for the particular entity deleted. For example, if you chose to delete the FIELD named Grade, and that field is contained in the ELEMENT Aspec, then all the CONTAINS records showing Aspec as containing the field will also be deleted.

H. QUERY SUBSYSTEM

There are two methods of accessing the QUERY menu, either by typing in the command "DO REPT-MENU" and striking the return key or selecting option 4 from the MAIN menu. In either case the QUERY menu will appear as follows:

This is the QUERY menu. It permits you to make ad-hoc inquiries. Queries are either of the 'forward' type where an entity is the subject and you specify the verb and object, or of the 'backward' type where the entity you give is the object of an action and subject.

QUERY MENU

1) Forward type (i.e. P3M calls what programs ?) (FORTREV)
2) Backward type (i.e. P3M is used by what offices ?) (BAKTREV)
3) Forward type for aliases (indicate type and system provides all aliases) (FORAL)
4) Backward type for aliases (give entity name and system (BAKAL) provides all aliases for that particular entity)
5) Forward type for categories (indicate type and system gives categories) (FORCAT)
6) Backward type for categories (give entity name and (BAKCAT) system gives all categories that entity is in)

0 to quit

Enter the selection here
WAITING 0

The system provides two types of queries, forward and backward. Forward means the user is presented columns of relations from which to pick. The columns, following the forward flow of the English language, are subject, verb and

object respectively. The user provides the unique name of the entity beside its type in the subject column; then marks one appropriate entry in the verb column and one appropriate entry in the object column. For example, to answer the question "What models does the office with symbol DAPC-PLF use ?" see Figure A.1 which depicts how the screen of the FORTREV program would appear and Figure A.2 depicts the output. Verb and object choices must be appropriate for the subject in that it is not possible to get any response from a query marked for which there is no relationship defined. For example, marking the screen of the FORTREV program to answer the question "What models contain what fields ? " would elicit no response when processed.

```
SUBJECTS              VERBS              OBJECTS
--------              -----              -------

Office:DAPC-PLF  :        Uses:X:         Reports: :
                     Maintains: :          Models:X:

 Model:          :       Calls: :         Programs: :
                       Inputs: :            Files: :
                      Outputs: :

  File:              :                    Elements: :
                        Contains: :
Element:          :                        Fields: :

  To quit put an X  in this field : :

Put the unique name of the entity you are querying about
in the field next to the entity's type.  Then place an X
in one appropriate verb field for that entity type and
an X in 1 appropriate object field.
I.E. Office:DAPC-PLF   :     Uses:X:      Models:X:
To process query move cursor through remaining
fields using RETURN key.
```

Figure A.1 Example of a Forward Retrieval

```
The office DAPC-PLF uses  the following models

P3M
OAS

Strike any key to continue...
WAITING
```

Figure A.2 Example of Forward Query Output

The backwards approach is implemented by presenting, from left to right, columns of objects, verbs and then subjects. Thus, to answer a question such as "What offices use the P3M model ?" the screen of the BAKTREV program would be marked as shown in Figure A.3 and Figure A.4 depicts how the output from this query would appear. Because the ALIAS and CATEGORY relations are each a special case, they are given their own respective forward (FORAL & FORCAT) and backward (BAKAL & BAKCAT) query programs.

I. REPORTS SUBSYSTEM

There are two methods of accessing the REPORT menu, either by typing in the command "DO REPT-MENU" and striking the RETURN key or selecting option 5 from the MAIN menu. In either case the menu will appear as follows:

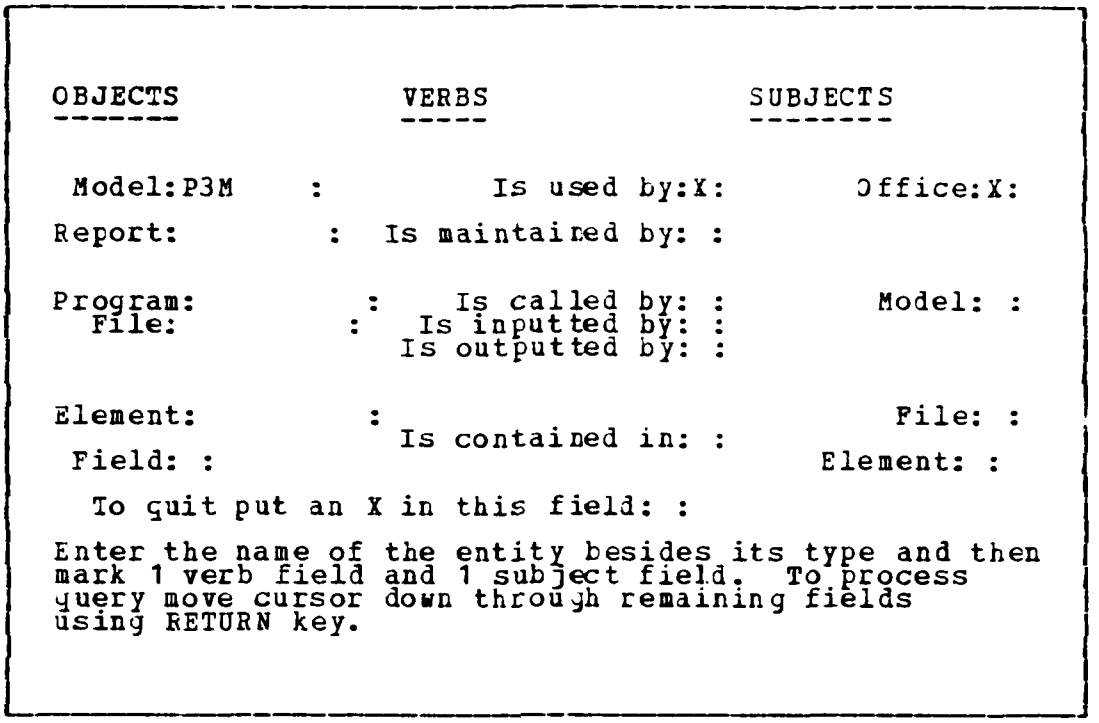


Figure A.3 Example of a Backward Retrieval

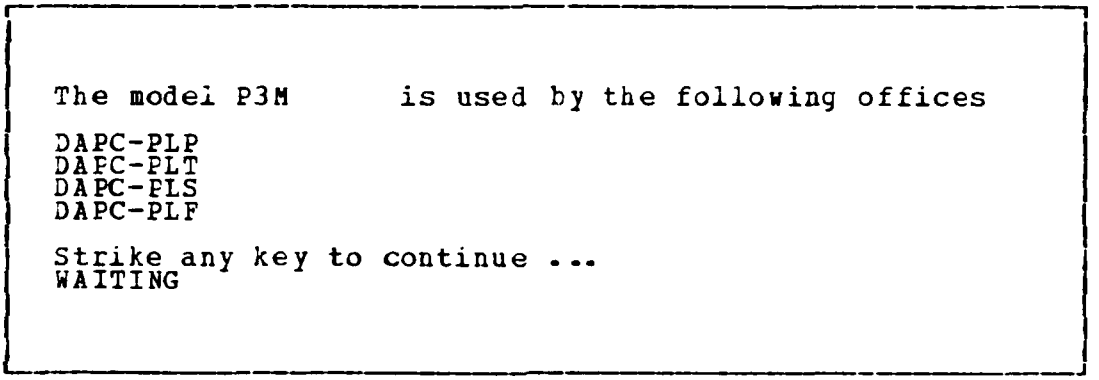


Figure A.4 Output From a Backwards Query

This is the REPORT menu. It permits you to print summary reports from the dictionary.

REPORT MENU

1) for a specific Model all users, maintainers, input & output files, programs called (SUMOD)

2) for a specific Report all users and models outputting it (SUMREP)

3) for a specific Office all models used, all models maintained, and reports used. (SUMOFF)

4) for a specific File all models it provides input to, receives output from, and elements it contains (SUMFIL)

0 to quit

Enter the selection here
WAITING

Before executing any Report menu option be sure the printer is both turned on and is "on line". Failure to have the printer turned on may result in your being thrown out of the data dictionary system and dBASE II and, therefore, to reinitialize. Select the report program you wish to execute. The system will then prompt you for the unique name of the entity concerned. For that specific entity, the system will then provide a printed summary report which provides all entities which have a direct relationship with the entity. Thus, if the you provide the unique name of a Model, the printed report would list:

1. All offices which use the Model.
2. All offices which maintain the Model.
3. All programs the Model calls.

4. All reports the Model outputs.

5. All files the Model either inputs from or outputs to.

For example, if you wished to have a summary report about for the P3M model you would select option 1 from the Reports menu for execution of the SUMOD program. The system would then prompt you as follows:

```
Please enter the unique name of the Model
Hit the space bar and RETURN to quit:P3M
```

```
The Model  P3M
Is used by the following offices:
DAPC-PLP
DAPC-PLT
DAPC-PLS
DAPC-PLF
Is maintained by the following offices with
the point of contact:
DAPC-PIF  KALINICH
Inputs the following files:
P3MDATA
Outputs to the following files:
P3MOUTPUT1
Outputs the following reports:
EPMR
P3MREP1
Calls the following programs
P3MPROGUNO1
P3MPROGDOS1
P3MPROGTRES1
Strike any key to continue
WAITING
```

Figure A.5 Example of Report Output

J. TERMINATING A SESSION

Having completed whatever work you wished to accomplish, you will now want to shut down the dictionary system.

1. If you have a menu up on the screen, select "0" and exit. If another menu appears, exit in the same manner. You will now have the period prompt on the screen indicating you are out of the dictionary system.
2. Type in the word "QUIT" and hit the RETURN key.
3. If you are using the demonstration system you will get the following prompt:

   A>

   If you are using the installed system you will get the following prompt:

   C>

4. If you were using the installed system, turn off the machine and you are done. If you were using the demonstration system, remove the floppy disks and store them in their paper sleeves.

APPENDIX B
DATA DICTIONARY SYSTEM'S DATA ELEMENTS

The following is an alphabetic listing of the fields used in the dictionary system. An asterisk following a file name denotes the field being discussed as being key to that file.

dBASE II FIELD NAME / ACRONYM: aname

FULLNAME: alias name

FORMAT: mixed

LENGTH: 15

FILES WHERE USED: Alias

DESCRIPTION: Name by which any entity is known other than its official name.

dBASE II FIELD NAME / ACRONYM: bldg

FULLNAME: building

FORMAT: mixed

LENGTH: 15

FILES WHERE USED: Office

DESCRIPTION: The building in which an office is located.

dBASE II FIELD NAME / ACRONYM: cat

FULLNAME: category

FORMAT: alphabetic

LENGTH: 16

FILES WHERE USED: Category

DESCRIPTION: The category in which an entity would be placed such as a field being a continuation rate.

dBASE II FIELD NAME / ACRONYM: comments

FULLNAME: comments

FORMAT: mixed

LENGTH: 45

FILES WHERE USED: office

DESCRIPTION: Any narrative information that illuminates on the office occuring in the record.

dBASE II FIELD NAME / ACRONYM: datatype

FULLNAME: datatype

FORMAT: alphabetic

LENGTH: 3

FILES WHERE USED: Field

DESCRIPTION: The type of data that a field could hold. The entry can be either A for alphabetic, N for numeric, AN for both or S for special. For example, for a field that could hold all three this entry would be ANS.

dBASE II FIELD NAME / ACRONYM: date

FULLNAME: date

FORMAT: numeric

LENGTH: 6

FILES WHERE USED: Element

DESCRIPTION: This is date an element was created.

dBASE II FIELD NAME / ACRONYM: description

FULLNAME: description

FORMAT: alphabetic

LENGTH: 45

FILES WHERE USED: Report, Model, Program,
File, Element, Field

DESCRIPTION: Verbal narrative illuminating on the
entity it is associated with.

dBASE II FIELD NAME / ACRONYM: domain

FULLNAME: domain

FORMAT: mixed

LENGTH: 45

FILES WHERE USED: Field

DESCRIPTION: The range of acceptable values
a field can take on.

dBASE II FIELD NAME / ACRONYM: editcri

FULLNAME: edit criteria

FORMAT: mixed

LENGTH: 45

FILES WHERE USED: Field

DESCRIPTION: Rules used to constrain and edit what values can occur in a field.

dBASE II FIELD NAME / ACRONYM: elname

FULLNAME: element name

FORMAT: mixed

LENGTH: 12

FILES WHERE USED: Element*

DESCRIPTION: Unique name of file element (not a data element or field, but the partition of a file).

dBASE II FIELD NAME / ACRONYM: ename

FULLNAME: entity name

FORMAT: mixed

LENGTH: 15

FILES WHERE USED: Alias*, Category*,Contains, Calls, Uses, Outputs, Inputs, Alias

DESCRIPTION: The unique name associated with an entity such as what could legally occur in mdl for a Model. This value would be the object of one of the verb relations.

dBASE II FIELD NAME / ACRONYM: ename1

FULLNAME: entity name #1

FORMAT: mixed

LENGTH: 15

FILES WHERE USED: contains*, Outputs*, Inputs*, Calls*

DESCRIPTION: The unique name associated with an entity and the subject of a verb relation.

dBASE II FIELD NAME / ACRONYM: etype

FULLNAME: entity type

FORMAT: alphabetic

LENGTH: 10

FILES WHERE USED: Contains, Outputs, Inputs, Calls

DESCRIPTION: Type of entity that ename specifies such as Model, Report, etc.

dBASE II FIELD NAME / ACRONYM: etype1

FULLNAME: entity type #1

FORMAT: alphabetic

LENGTH: 10

FILES WHERE USED: Contains*, Outputs*, Inputs*, Calls*

DESCRIPTION: Type of entity that ename1 is specifying such as Model, Report, etc.

dBASE II FIELD NAME / ACRONYM: fld

FULLNAME: field

FORMAT: mixed

LENGTH: 15

FILES WHERE USED: Field*

DESCRIPTION: The unique name of a field.

dBASE II FIELD NAME / ACRONYM: fname

FULLNAME: file name

FORMAT: mixed

LENGTH: 16

FILES WHERE USED: File*

DESCRIPTION: The unique name of a file.

dBASE II FIELD NAME / ACRONYM: fullname

FULLNAME: full name

FORMAT: mixed

LENGTH: 25

FILES WHERE USED: Report, File

DESCRIPTION: The non-unique and fully expanded name of either a report or file.

dBASE II FIELD NAME / ACRONYM: language

FULLNAME: language

FORMAT: mixed

LENGTH: 10

FILES WHERE USED: Program

DESCRIPTION: The computer language
a program is written in, such as
FORTRAN 77.

dBASE II FIELD NAME / ACRONYM: lstupdate

FULLNAME: last update

FORMAT: numeric, YYMMDD

LENGTH: 6

FILES WHERE USED: File

DESCRIPTION: The most recent date of
a file having been updated.

dBASE II FIELD NAME / ACRONYM: length

FULLNAME: length

FORMAT: numeric

LENGTH: 3

FILES WHERE USED: Field

DESCRIPTION: The size of a field in bytes.

dBASE II FIELD NAME / ACRONYM: location

FULLNAME: location

FORMAT: mixed

LENGTH: 16

FILES WHERE USED: Model, Program

DESCRIPTION: The file where a program or model

is stored on the computer.

dBASE II FIELD NAME / ACRONYM: mdl

FULLNAME: model

FORMAT: mixed

LENGTH: 8

FILES WHERE USED: Model*, Maintains*

DESCRIPTION: The unique abbreviation or acronym associated with a Model.

dBASE II FIELD NAME / ACRONYM: media

FULLNAME: storage media

FORMAT: alphabetic

LENGTH: 10

FILES WHERE USED: File

DESCRIPTION: The type medium used to store a file, i.e. tape or disk.

dBASE II FIELD NAME / ACRONYM: method

FULLNAME: methodology

FORMAT: alphabetic

LENGTH: 45

FILES WHERE USED: Model

DESCRIPTION: The Operations Research solution techniques used by a model such as Linear Programming.

dBASE II FIELD NAME / ACRONYM: modelpoc

FULLNAME: model point of contact

FORMAT: alphabetic

LENGTH: 15

FILES WHERE USED: Maintains

DESCRIPTION: The individual to be contacted regarding maintanance of a model.

dBASE II FIELD NAME / ACRONYM: modname

FULLNAME: model name

FORMAT: mixed

LENGTH: 30

FILES WHERE USED: Model

DESCRIPTION: The fully expanded, non-unique name of a Model.

dBASE II FIELD NAME / ACRONYM: nullstat

FULLNAME: nullstatus

FORMAT: alphabetic

LENGTH: 1

FILES WHERE USED: Field

DESCRIPTION: Indicates whether a field can have the null status or some value must always be present.

dBASE II FIELD NAME / ACRONYM: number

FULLNAME: number

FORMAT: mixed

LENGTH: 9

FILES WHERE USED: Office

DESCRIPTION: The number assigned to a report by the computer operations organization of MILPERCEN.

dBASE II FIELD NAME / ACRONYM: cfc

FULLNAME: office symbol

FORMAT: alphabetic

LENGTH: 9

FILES WHERE USED: Office*, Uses*

DESCRIPTION: The unique symbol which identifies an office of either DCSPLANS or some other organization, for example *PERSINSD*.

dBASE II FIELD NAME / ACRONYM: cname

FULLNAME: office name

FORMAT: mixed

LENGTH: 35

FILES WHERE USED: File

DESCRIPTION: The expanded, non-unique name of an office, such Deputy Chief of Staff for Plans for DCSPLANS.

dBASE II FIELD NAME / ACRONYM: outfrmat

FULLNAME: output format

FORMAT: alphabetic

LENGTH: 15

FILES WHERE USED: Report

DESCRIPTION: The form a report takes such as hard copy, tape, or microfice.

dBASE II FIELD NAME / ACRONYM: phone

FULLNAME: telephone number

FORMAT: mixed

LENGTH: 21

FILES WHERE USED: Office

DESCRIPTION: The telephone number of an office.

dBASE II FIELD NAME / ACRONYM: pname

FULLNAME: program name

FORMAT: alphabetic

LENGTH: 15

FILES WHERE USED: Program*

DESCRIPTION: The unique identifier of a program.

dBASE II FIELD NAME / ACRONYM: periodicity

FULLNAME: periodicity of entity

FORMAT: mixed

LENGTH: 4

FILES WHERE USED: Report, Model, Program

DESCRIPTION: How frequently a report, program, or model is executed or produced. Coded by

a number and then the time period. For example, 2W means twice monthly, 3Q means thrice quarterly.

dBASE II FIELD NAME / ACRONYM: poc

FULLNAME: point of contact

FORMAT: alphabetic

LENGTH: 15

FILES WHERE USED: Office, File, Element, and Field

DESCRIPTION: The individual to be contacted if having problems or need information about the associated entity.

dBASE II FIELD NAME / ACRONYM: purpose

FULLNAME: purpose

FORMAT: alphabetic

LENGTH: 45

FILES WHERE USED: Report, Model, Program, File, Field, and Element

DESCRIPTION: The function and reason for existence of an entity.

dBASE II FIELD NAME / ACRONYM: rname

FULLNAME: report name

FORMAT: mixed

LENGTH: 10

FILES WHERE USED: Report*

DESCRIPTION: The unique identifier of a Report.

dBASE II FIELD NAME / ACRONYM: seqnum

FULLNAME: sequence number

FORMAT: numeric

LENGTH: 5

FILES WHERE USED: Element

DESCRIPTION: Location of an element within the file that holds it. Elements are both named and marked by their sequential position in the file.

dBASE II FIELD NAME / ACRONYM: room

FULLNAME: room number

FORMAT: mixed

LENGTH: 6

FILES WHERE USED: Office

DESCRIPTION: Room where an office is located.

dBASE II FIELD NAME / ACRONYM: runame

FULLNAME: run stream name

FORMAT: mixed

LENGTH: 15

FILES WHERE USED: Model

DESCRIPTION: The unique name of a run stream (Job Control Language procedure) that results in Model being executed.

dBASE II FIELD NAME / ACRONYM: size

FULLNAME: size

FORMAT: numeric

LENGTH: 3

FILES WHERE USED: Element

DESCRIPTION: Length in bytes of an occurrence in an element. All occurrences in an element are the same size and the format of the element is likened to a record.

dBASE II FIELD NAME / ACRONYM: seclass

FULLNAME: security classification

FORMAT: alphabetic

LENGTH: 2

FILES WHERE USED: Report, Field

DESCRIPTION: Highest level of classified information the entity contains. Coded as U, C, S or TS.

dBASE II FIELD NAME / ACRONYM: source

FULLNAME: source

FORMAT: mixed

LENGTH: 15

FILES WHERE USED: Field

DESCRIPTION: The document or source which explains or specifies what values can occur in a field. For example, AR 611-201 specifies what would occur in a

field for enlisted military occupational specialty.

dBASE II FIELD NAME / ACRONYM: status

FULLNAME: development status

FORMAT: alphabetic

LENGTH: 15

FILES WHERE USED: Report, Model, Program, File, Field

DESCRIPTION: The development status of an entity such as test, operational, retired.

dBASE II FIELD NAME / ACRONYM: version

FULLNAME: version

FORMAT: numeric

LENGTH: 3

FILES WHERE USED: Program*

DESCRIPTION: The edition number of a program and therefore an indicator of uniqueness. For example, ADSPEC3.

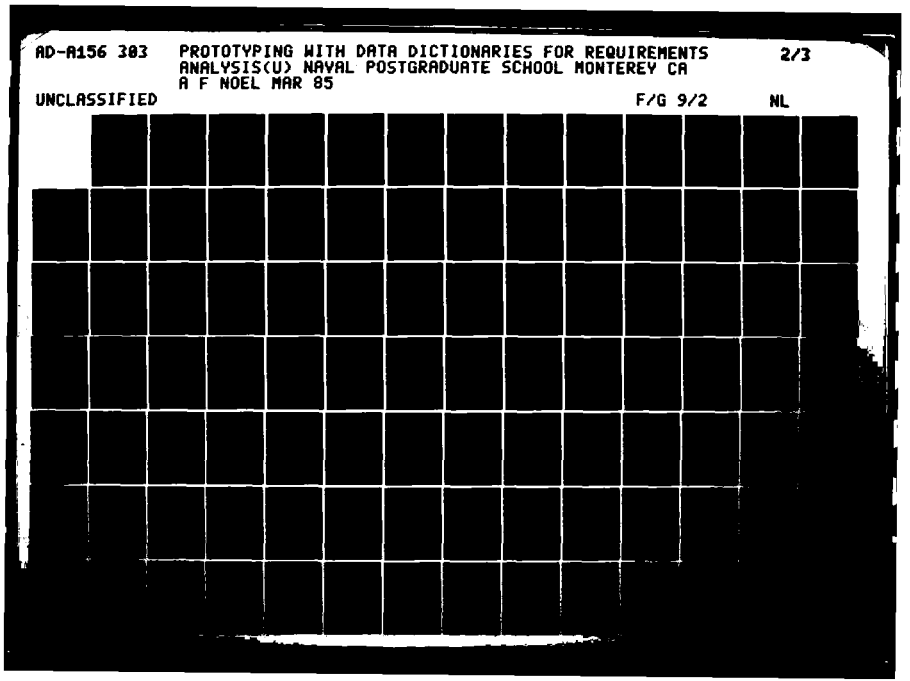
APPENDIX C

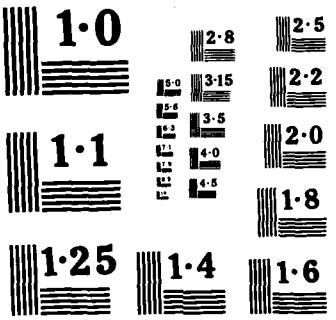
DATA DICTIONARY SOURCE LISTING

```
* main.prg
*
* programmer: al noel
*
* purpose: present main menu for dictionary system
*
*
*
SET COLOR TO 30,14
set talk off
ERASE
* set up a loop for the user to select which major function to be done
DO WHILE T
 2,0
      TEXT
         This is the MAIN menu for the data dictionary system.
         The  system allows you to add, change, or delete records  and
         to process queries.  Please enter the number of the function you wish
         to perform:

                                   0 to quit

              1 add a new record                (ADD-MENU)
              2 change a record                 (CHG-MENU)
              3 delete a record                 (DEL-MENU)
              4 run a query                     (QERY-MENU)
              5 print a report                  (REPT-MENU)

         Enter the selection here
   ENDTEXT
   WAIT TO Mselect
* erase error message, if there was any
 20,0
 21,0
*  case statement to select calling of major function menu per user choice
DO CASE
        CASE Mselect = 0
           USE
           ERASE
           RELEASE ALL
           RETURN
        CASE Mselect = 1
```

```
        do add-menu
      CASE Mselect = 2
        do chg-menu
      CASE Mselect = 3
        do del-menu
      CASE Mselect = 4
         do qery-menu
      CASE Mselect = 5
         do rept-menu
        * present error message
        OTHERWISE
          erase
          20,3 SAY Please enter values between 0 and 5 only
          21,3 SAY Please try again
    ENDCASE
  ENDDO
RETURN

* add-menu.prg
*
* programmer: al noel
*
* purpose: to present menu for add subsystem
*
* set color to yellow and blue
SET COLOR TO 30,14
SET TALK OFF
* clear screen
ERASE
DO WHILE T
  2,0
   TEXT
                          ADD MENU

                           0 to quit

      1 Model (ADD-MODEL)              5 File (ADD-FI)
      2 Office (ADD-OFFICE)            6 Element (ADD-EL)
      3 Report (ADD-REP)               7 Field (ADD-FE)
      4 Program (ADD-PRO)              8 Alias (ADD-AL)
                                       9 Category (ADD-CAT)

  Enter the selection here
ENDTEXT
WAIT TO AMSELECT
 20,0  SAY
 21,0  SAY
```

```
* case statement to call program based upon users choice
DO CASE
   CASE AMSELECT = 0
      CLEAR
      ERASE
      RELEASE ALL
      RETURN
   CASE AMSELECT = 1
     DO ADD-MODEL
   CASE AMSELECT = 2
     DO ADD-OFFICE
   CASE AMSELECT = 3
     DO ADD-REP
   CASE AMSELECT = 4
      DO ADD-PRO
   CASE AMSELECT = 5
      DO ADD-FI
   CASE AMSELECT = 6
      DO ADD-EL
   CASE AMSELECT = 7
      DO ADD-FE
   CASE AMSELECT = 8
     DO ADD-AL
  CASE AMSELECT = 9
     DO ADD-CAT
   * present error message to user
   OTHERWISE
      ERASE
      20,3 SAY PLEASE ENTER VALUES BETWEEN 0 AND 9 ONLY
      21,3 SAY PLEASE TRY AGAIN
   ENDCASE
ENDDO
RETURN


* add-model.prg
*
* programmer: al noel
*
* purpose: allow user to add a new model record to dictionary
*
* files used: model, imodel, uses, maintains
*
SET FORMAT TO SCREEN
set exact on
set talk off
ERASE
```


AD-A156 303 PROTOTYPING WITH DATA DICTIONARIES FOR REQUIREMENTS ANALYSIS(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA A F NOEL MAR 85
2/3
UNCLASSIFIED
F/G 9/2
NL



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

```
REMARK STANDBY PLEASE...
USE MCDEL
* index on unique name so can check if user providing new model
INDEX ON MDL TO IMODEL
set color to 30,14
do while t
   erase
   ?          'ADDING NEW MODEL TO DATA DICTIONARY'
   ?
   ?      Enter the Model's unique name and hit RETURN
   accept To quit hit the space bar once and then RETURN  TO  AMSHORNAME
   *  check to quit
   if amshorname =    .OR. AMSHORNAME =      .OR. AMSHORNAME =
      erase
      clear
      release all
      return
   endif
  use model index imodel
  * check if model name already exists
  Find &amshorname
  if
 <> 0
     erase
     ?
     ?
     ? A record for the Model named , amshorname, already exists
     store 1 to xx
     do while xx < 45
        store xx+1 to xx
     enddo
ELSE
   erase
  * initialize variables for use in screen
  store          to ammdl
  store                                    to ammodname
  store                                                  to ammeth
  store                     to amstatus
  store                      to amlocation
  store                                                  to ampurpose
  store                                                  to amdescrip
  store                   to amruname
  store          to amperiod
  store t to xflag
  * present screen
  do while xflag
  2,3 say    Model unique name get ammdl
 4,3 say      Model full name get ammodname
```

```
 6,3   say    Methodology get ammeth
 8,3 say      Status get amstatus
10,3 say       Location get amlocation
12,3 say       Purpose  get ampurpose
14,3 say       Description get amdescrip
16,3 say       Runstream get amruname
18,3 say       Periodicity get amperiod
read
    store f to errflag
    if .not. errflag
      store f to xflag
    endif
  enddo while xflag
   * create new blank record to load
   append blank
   * load new record from whats on screen
   replace mdl with !(ammdl), mdlname with !(ammodname)
   replace location with !(amlocation), purpose with !(ampurpose)
   replace descrip with !(amdescrip), runame with !(amruname)
   replace period with !(amperiod), status with !(amstatus)
   replace method with !(ammeth)

   erase
   store t to offlag
     do while offlag
        ? Enter the symbol for the office using this model and RETURN
        accept To quit entering offices hit the space bar and RETURN to amoff

        *check to quit
        if amoff =    .or. amoff =      .or. amoff =
           store f to offlag
           erase
        else
           use uses
           append blank
           replace ofc with !(amoff), ename with !(ammdl) ,etype with MODEL
           erase

        endif
    enddo while offlag
* store maintainers
        store t to flag
        do while flag
 ?Enter office symbol for office maintaining this model and RETURN
 accept To quit entering maintainers hit space bar and RETURN to amoff
        if amoff =    .or. amoff =    .or. amoff =
          store f to flag
          erase
```

```
         else
accept Who is the point of contact ? to ampoc
            use maintains
            append blank
            replace ofc with !(amcff), mdl with !(ammdl)
            replace modelpoc with !(ampoc)
            erase
         endif
  enddo while flag
ENDIF
erase
enddo
```

```
* add-office.prg
*
* programmer: al noel
*
* purpose: to permit user to add a new office record to dictionary
*
* files used: office, ioffice
*
SET FORMAT TO SCREEN
set exact on
set talk off
set color to 30,14
ERASE
REMARK STANDBY PLEASE ...
* index file so can check if record with unique office symbol already exists
USE OFFICE
INDEX ON OFC TO IOFFICE
USE OFFICE INDEX IOFFICE
do while t
   erase
   ?          'ADDING NEW OFFICE TO THE DATA DICTIONARY'
   ?
   ?   Enter the Office's unique symbol and hit RETURN
   accept To quit hit the space bar once and then RETURN  TO  AMSHORNAME
   * check to quit, if blank, quit
   if amshorname =   .OR. AMSHORNAME =     .OR. AMSHORNAME =
      erase
      clear
```

```
      release all
      return
    endif
   * check if office symbol user gives is truly unique & therefore addable
   Find &amshorname
   if
  <> 0
      erase
      ?
      ?
      ? A record for an Office with symbol , amshorname, already exists
      store 1 to xx
      do while xx < 45
         store xx+1 to xx
      enddo
ELSE
   erase
   * initialized screen variables
   store            to amofc
   store                                        to amoname
   store                  to ambldg
   store        to amroom
   store                        tc amphone
   store                                                  to amcomments
   store                   to ampoc

   store t to xflag

   do while xflag
   * put up screen
   2,3 say    Office's unique symbol get amofc
  4,3 say      Office's full name get amoname
  6,3   say    Building    get ambldg
  8,3 say      Room   get amroom
  10,3 say      Phone number get  amphone
  12,3 say      Comments get amccmments
  14,3 say      Point of Contact get ampoc
read
    store f to errflag
    if .not. errflag
      store f to xflag
    endif
   enddo while xflag
    * create new blank record and load with data from screen
    append blank
    replace ofc with !(amofc), oname   with !(amoname  )
    replace bldg     with !(ambldg)    , room    with !(amroom    )
    replace phone   with !(amphone  ), comments with !(amcomments)
```

```
   replace poc     with !(ampoc    )

   erase
ENDIF
erase
enddo


* add-alias.prg
*
* purpose: to add a new alias record to dictionary
*
* programmer : al noel
*
* files used: alias, ialias
*
SET FORMAT TO SCREEN
set exact on
set talk off
set color to 30,14
ERASE
REMARK STANDBY PLEASE...
* index so can check for uniqueness of user's entry for name
USE ALIAS
INDEX ON ENAME - ANAME TO IALIAS
USE ALIAS INDEX IALIAS
do while t
   erase
   ?          'ADDING NEW ALIAS TO THE DATA DICTIONARY'
   ?
   ?
   ? To quit hit space and RETURN for the following two prompts
   ?
   ?
  accept  Enter the Entity's    unique name and hit RETURN to part1
  accept  Enter the Entity's alias and hit RETURN            to part2
    * check to quit
   if part2       =    .OR. part2       =      .OR. part2       =
      erase
      clear
      release all
      return
   endif
  store part1 - part2 to key
  * check for uniqueness of entry given by user
  Find &key
  if
```

```
 <> 0
     erase
     ?
     ?
? A record for an Entity named ,part1, with alias of      ,part2
?     already exists
     store 1 to xx
     do while xx < 45
        store xx+1 to xx
     enddo
ELSE
   erase
  * init screen variables
  store  part1              to amename
  store   part2                        to amaname
  store              to ametype

  store t to xflag

  do while xflag
* put up screen
 2,3   say    Entity's  unique name get amename
 4,3 say      Alias get amaname
 6,3   say    Type of entity (i.e. MODEL, or REPORT) get ametype
read
    store f to errflag
    if .not. errflag
      store f to xflag
    endif
  enddo while xflag
   * create new blank record and load with data from screen
   append blank
   replace ename with !(amename   ), aname    with !(amaname)
   replace etype    with !(ametype   )
   erase
ENDIF
erase
enddo



* add-report.prg
*
* programmer: al noel
*
* purpose: to permit user to add a new report record to dictionary
```

```
*
* files used: report, ireport, uses, outputs
*
set exact on
SET FORMAT TO SCREEN
set talk off
set color to 30,14
ERASE
* index report file so can check if name given is truly unique and new
REMARK STANDBY PLEASE..
USE REPORT
INDEX ON RNAME TO IREPORT
do while t
   USE REPORT INDEX IREPORT
   erase
   ?            'ADDING NEW REPOET TO THE DATA DICTIONARY'
   ?
   ?
   ? To quit hit the space bar and RETURN
   ?
   ?
  accept  Enter the Report's   unique name and hit RETURN to part1
   * check if blank entered to quit or not
   if part1      =   .OR. part1      =     .OR. part1      =
      erase
      clear
      release all
      return
   endif
  store part1          to key
  * check if name given by user is truly unique
  find &key
  if
 <> 0
     erase
     ?
     ?
? A record for a Report  named ,part1, already exists
     store 1 to xx
     do while xx < 55
        store xx+1 to xx
     enddo
ELSE
   erase
   * init screen variables
  store                  to amrname
  store                                to amfullname
  store                                                to ampurpose
```

```
store                                                    to amdescrip
store              to amnumber
store                  to amstatus
store        to amperiod
store    to amseclass
store                  to amoutfrmat

store t to xflag

do while xflag
 * present screen
 2,3 say    Report's  unique name get amrname
4,3 say      Report's full name  get    amfullname
6,3   say    Purpose     get ampurpose
8,3 say      Description get amdescrip
10,3 say      Number   get amnumber
12,3 say      Status      get amstatus
14,3 say      Periodicity get amperiod
16,3 say Security classification get     amseclass
18,3 say Output format get amoutfrmat
read
   store f to errflag
   if .not. errflag
     store f to xflag
   endif
 enddo while xflag
  * create new blank record and load with data from screen
  append blank
  replace rname with !(amrname   ), fullname with !(amfullname)
  replace purpose  with !(ampurpose ), descrip with !(amdescrip)
  replace number  with !(amnumber ), status   with !(amstatus  )
  replace period with !(amperiod), seclass with !(amseclass)
  replace outfrmat      with !(amoutfrmat       )
  erase
  store t to offlag
    do while offlag
 ? Enter the symbol for the Office which uses this Report
 ?    and then hit RETURN
?
?
  * put intersection record in for office using report just entered
  * if blanlk then quit this phase of program
      accept To quit entering Offices hit the space bar and RETURN to amoff
      if amoff =    .or. amoff =      .or. amoff =
         store f to offlag
         erase
      else
         use uses
```

```
            append blank
            replace ofc    with !(amoff), ename  with !(amrname)
            replace etype with REPORT
            erase
         endif
      enddo while offflag
      erase
      store t to flag
        * put in intersection record for models outputting report
        do while flag
           ? Enter the unique name for the Model that outputs this Report
           ?  and then hit RETURN
           ?
           * check to quit entering models
     accept To quit entering Models hit the space bar and then RETURN to amof
           if amof =    .or. amof =    .or. amof =
              clear
              store f to flag
              erase
         else
            use outputs
            append blank
            replace ename1 with !(amof) , etype1 with MODEL
            replace ename with !(amrname), etype with REPORT
            erase
         endif
       enddo while flag
ENDIF
erase
enddo



* add-field.prg
*
* purpose: to add a new field to the dictionary
*
* programmer: al noel
*
* files used: field, ifield, contains
*
*
set exact on
SET FORMAT TO SCREEN
set talk off
set color to 30,14
```

```
ERASE
REMARK STANDBY PLEASE ...
* index on unique name so can check for unique new name coming from user
USE FIELD
INDEX ON FLD TO IFIELD
do while t
   USE FIELD INDEX IFIELD
   erase
   ?          'ADDING NEW FIELD TO THE DATA DICTIONARY'
   ?
   ?    Enter the Field's  unique name   and hit RETURN
   * check to quit
   accept To quit hit the space bar once and then RETURN  TO  AMSHORNAME
   if amshorname =    .OR. AMSHORNAME =     .OR. AMSHORNAME =
      erase
      clear
      release all
      return
   endif
  * check for unique name already existing, if so, tell user
  Find &amshorname
  if
 <> 0
     erase
     ?
     ?
     ? A record for a Field with the name , amshorname, already exists
     store 1 to xx
     do while xx < 45
        store xx+1 to xx
     enddo
ELSE
   erase
  * init screen variables
  store                    to amfld
  store        to amlength
  store      to amdatatype
  store    to amnullstat
  store                    to amsource
  store                                                  to amdomain
  store                                                  to ampurpose
  store                                                  to amdescrip
  store                    to amstatus
  store     to amseclass
  store                   to ampoc

  store t to xflag
```

```
   do while xflag
      set format to fedat.fmt
      read
     store f to errflag
     if .not. errflag
       store f to xflag
     endif
   enddo while xflag
    * create new blank record and load with data from screen
    append blank
    replace fld with !(amfld), length  with !(amlength )
    replace datatype with !(amdatatype), nullstat with !(amnullstat  )
    replace source  with !(amsource ), domain   with !(amdomain   )
    replace purpose with !(  ampurpose ), descrip with !(amdescrip)
    replace status with !(amstatus), seclass with !(amseclass)
    replace poc with !(ampoc)
    erase
    store T to offflag
    do while offflag
    erase
    ? 'Enter the unique name for the Element which contains this Field'
    ? 'and then hit RETURN'
    ?
    ?
    accept 'To quit entering Elements hit the space bar and RETURN' to amoff
    * check to quit entering elements that contain field
    if amoff = ' ' .or. amoff = '  ' .or. amoff = '   '
       clear
       store f to offflag
       erase
    else
       * put in intersection record in contains file for new field
       use contains
       append blank
       replace ename1 with !(amoff), etype1 with 'ELEMENT'
       replace ename with !(amfld), etype with 'FIELD'
    endif
    enddo while offflag
    erase
  ENDIF
  erase
  enddo



  * add-program.prg
```

```
*
* purpose: to add a new program record to dictionary
*
* programmer: al noel
*
* files used: program, iprogram
*
set exact on
SET FORMAT TO SCREEN
set talk off
set color to 30,14
ERASE
* index file so can check for uniqueness of entry given by user
remark STANDBY WHILE I INDEX FILE PLEASE
use program
index on pname - version to iprogram
* set up loop to do work
do while t
   erase
   ?              'ADDING NEW PROGRAM TO THE DATA DICTIONARY'
   ?
   ?
   ? To quit hit space and RETURN for the following two prompts
   ?
   ?
  accept  Enter the Program's  unique name and hit RETURN to part1
  accept  Enter the Program's version number and hit RETURN to part2
* check to quit or do work
   if part2      =    .OR. part2      =      .OR. part2      =
      erase
      clear
      release all
      return
   endif
  use program  index iprogram
  store part1 - part2 to key
* look for record with unique name and version as given by user
*
  Find &key
* if no find, tell user and ask if he wishes to continue
  if
 <> 0
     erase
     ?
     ?
? A record for a Progran named ,part1, with version number,part2
?      already exists
     store 1 to xx
```

```
      do while xx < 45
         store xx+1 to xx
      enddo
ELSE
   erase
* init screen variables
  store                    to ampname
  store                                    to amlocation
  store                to amlanguage
  store      to amversion
  store                                                    to ampurpose
  store                                                    to amdescrip
  store                    to amstatus
  store          to amperiod
  store t to xflag

  do while xflag
* put up screen for user to load with data
  2,3 say    Program's unique name get ampname
 4,3 say      Location get amlocation
 6,3   say    Version     get amversion
 8,3 say      Status get amstatus
 10,3 say      Purpose  get ampurpose
 12,3 say      Description get amdescrip
 14,3 say      Periodicity get amperiod
 16,3 say Language get amlanguage
read
    store f to errflag
    if .not. errflag
      store f to xflag
    endif
  enddo while xflag
   use program  index iprogram
    * create new blank record and load with data from screen user gave u
   append blank
   replace pname with !(ampname   ), location with !(amlocation)
   replace version  with !(amversion ), purpose with !(ampurpose)
   replace descrip with !(amdescrip), language with !(amlanguage)
   replace period with !(amperiod), status with !(amstatus)

   erase
   store t to offlag
     do while offlag
 * prompt to build calls record of model that calls program just entered
 ? Enter the unique name for the Model which calls this Program
 ?    and then hit RETURN
?
?
```

```
        accept To quit entering Models  hit the space bar and RETURN to amoff

        if amoff =    .or. amoff =      .or. amoff =
           clear
           store f to offflag
           erase
        else
           use calls
           store ampname - amversion to holder
           append blank
           replace ename1 with !(amoff), etype1 with MODEL
           replace ename with !(holder), etype with PROGRAM
           erase

        endif
     enddo while offlag
  ENDIF
  erase
  enddo
```



```
  * add-file.prg
  *
  * purpose: to add a new file to the data dictionary
  *
  * programmer: al noel
  *
  * file used: file, ifile, contains, inputs, outputs
  *
  SET FORMAT TO SCREEN
  set exact on
   set talk off
  set color to 30,14
  ERASE
  REMARK STANDBY PLEASE...
  * index so can check for unique file name by user
  USE FILE
  INDEX ON FNAME TO IFILE
  do while t
     USE FILE INDEX IFILE
     erase
     ?              'ADDING NEW FILE TO DATA DICTIONARY'
     ?
     ? To quit hit space bar and then RETURN for the following prompt
```

```
      ?
      ?
     accept  Enter the File's unique name and then hit RETURN to part1
      *    ck to quit
      if part1      =    .OR. part1      =      .OR. part1      =
         erase
         clear
         release all
         return
      endif
     * check if name given by user is unique , if not tell him so
     Find &part1
     if
    <> 0
        erase
        ?
        ?
   ? A record for a File named     ,part1, already exists
        store 1 to xx
        do while xx < 55
           store xx+1 to xx
        enddo
   ELSE
      erase
      * init screen variables
     store PART1                    to amfname
     store                                          to amfullname
     store                 to ammedia
     store    to amseclass
     store                                                to ampurpose
     store                                                to amdescrip
     store                      to amstatus
     store                      to ampoc
     store '      ' to amlstupdat
     store t to xflag

     do while xflag
      * est. screen
      set format to fidat.fmt
      read
       store f to errflag
       if .not. errflag
         store f to xflag
       endif
      enddo while xflag
      * create new blank record and load with data from screen
      append blank
      replace fname with !(amfname   ), fullname with !(amfullname)
```

```
   replace media    with !(ammedia   ), status  with !(amstatus )
   replace descrip with !(amdescrip), purpose  with !(ampurpose )
   replace poc    with !(ampoc   ), seclass with !(amseclass)
   replace lstupdat with amlstupdat
   erase
   store t to offlag
     do while offlag
 ? Enter the unique name for a Model that receives input from this File
 ?    and then hit RETURN
?
?
       * create intersection records for inputs file
        accept To quit entering Models   hit the space bar and RETURN to amof

        if amof  =    .or. amof  =      .or. amof  =
           store f to offlag
           erase
        else
           use inputs
           append blank
           replace ename1 with !(amof ), etype1 with MODEL
           replace ename with !(amfname), etype with FILE
           erase
        endif
    enddo while offlag

 erase
store t to flag
 do while flag
  ? Enter the unique name for a Model that outputs to this File
 ?  and then hit RETURN
?
?
* create intersection record for outputs file
accept To quit entering Models hit the space bar and RETURN  to amof
if amof =   .or. amof =    .or. amof =
   clear
   store f to flag
   erase
else
   use outputs
   append blank
   replace ename1 with !(amof), etype1 with MODEL
 replace ename with !(amfname),      etype with FILE
   erase
ENDIF
 enddo while flag
```

```
endif
erase
enddo



* add-element.prg
*
* purpose: to add a new element to the dictionary
*
* programmer: al noe
*
* files used: element, ielement, contains
*
set exact on
SET FORMAT TO SCREEN
set talk off
set color to 30,14
ERASE
REMARK STANDBY PLEASE...
* index so can check for uniqueness
USE ELEMENT
INDEX ON ELNAME TO IELEMENT
do while t
   USE ELEMENT INDEX IELEMENT
   erase
   ?           'ADDING NEW ELEMENT TO THE DATA DICTIONARY'
   ?
   ?
   ? To quit hit the space bar and RETURN
   ?
   ?
  accept  Enter the Element's  unique name and hit RETURN to part1
    * check to quit using program
    if part1      =    .OR. part1      =      .OR. part1      =
       erase
       clear
       release all
       return
    endif
   store part1          to key
   * check for uniqueness of entry given by user
   Find &key
   if
  <> 0
      erase
```

```
      ?
      ?
? A record for a Element named ,part1, already exists
      store 1 to xx
      do while xx < 55
         store xx+1 to xx
      enddo
ELSE
   erase
  * init screen variables
  store                        to amelname
  store     to amversion
  store        to amdate
  store        to amseqnum
  store     to amsize
  store                  to ampoc
  store                                          to ampurpose
  store                                          to amdescrip

  store t to xflag

  do while xflag
*  put up screen so user can load data
set format to eldat
read
     store f to errflag
     if .not. errflag
       store f to xflag
     endif
  enddo while xflag
   append blank
   * load record with data from screen
   replace   elname with !(amelname  ), version  with !(amversion )
   replace date    with !( amdate    ), seqnum  with !(amseqnum )
   replace size    with !(amsize     ), poc     with !(ampoc     )
   replace purpose with !(ampurpose), descrip with !(amdescrip)
   erase
   store t to offflag
     do while offflag
 ? Enter the unique name for the File which contains this element
 ?    and then hit RETURN
?
?
        * add intersection record for contains file
        accept To quit entering Files   hit the space bar and RETURN to amoff
        if amoff =    .or. amoff =      .or. amoff =
           clear
           store f to offflag
```

```
            erase
         else
            use contains
            append blank
            replace ename1 with !(amoff), etype1 with FILE
            replace ename with !(amelname), etype with ELEMENT
            erase

         endif
      enddo while offlag
   ENDIF
   erase
   enddo



   * add-category.prg
   *
   * purpose: to add a new category record to the dictionary
   *
   * programmer: al noel
   *
   * files used: category, icategory
   *
   set exact on
   SET FORMAT TO SCREEN
   set talk off
   set color to 30,14
   ERASE
   REMARK STANDBY PLEASE
   * index so can check for uniqueness of new entry by user
   USE CATEGORY
   INDEX ON ENAME - ETYPE TO ICATEGORY
   USE CATEGORY INDEX ICATEGORY
   do while t
      erase
      ?          'ADDING NEW CATEGORY TO DATA DICTIONARY'
      ?
      ? To quit hit space and RETURN for the following two prompts
      ?
      ?
     accept  Enter the Entity's   unique name and hit RETURN to part1
     accept  Enter the Entity's type (i.e. MODEL )  and hit RETURN  to part2
      * check to quit, if blank quit, else, go on
      if part2      =   .OR. part2      =     .OR. part2      =
         erase
```

```
        clear
        release all
        return
     endif
    store part1 - part2 to key
     * check for uniqueness , if not unique , tell user and don't allow entry
    Find &key
    if
  <> 0
        erase
        ?
        ?
? A record for an Entity named ,part1, with a type of     ,part2
?      already exists
        store 1 to xx
        do while xx < 45
           store xx+1 to xx
        enddo
ELSE
    erase
   * init screen variables
   store  part1              to amename
   store   part2                              to ametype
   store                to amcat

   store t to xflag

   * put up screen for user to load data into
   do while xflag
   set format to catdat
read
     store f to errflag
     if .not. errflag
       store f to xflag
     endif
   enddo while xflag
    * create new blank record and load with data from screen
    append blank
    replace ename with !(amename   ), cat      with !(amcat  )
    replace etype    with !(ametype   )

    erase
ENDIF
erase
enddo
```

```
* PROGRAM CHG-MENU
*
* purpose: permit user to select change program he wishes to execute
*
* programmer: al noel
*
SET COLOR TO 30,14
SET TALK OFF
* CLEAR SCREEN
ERASE
* SET UP DO LOOP FOR SELECTIONS
DO WHILE T
   2,0
       TEXT
          This is the CHANGE menu. It permits you to change records in
          any file.  Please enter the number of the function you wish to
          perform.

                              0 to quit

       1 Model   (CHG-MODEL)          5 File (CHG-FI)
       2 Office  (CHG-OFFICE)         6 Element (CHG-EL)
       3 Report  (CHG-REP)            7 Field (CHG-FE)
       4 Program (CHG-PRO)            8 Alias (CHG-AL)
                                      9 Category (CHG-CAT)


       Enter the selection here
ENDTEXT
WAIT TO CMSELECT
 20, 0   SAY
 21, 0   SAY
* CASE STATEMENT TO CALL PROGRAM BASED UPON USERS CHOICE
DO CASE
   CASE CMSELECT = 0
       USE
       ERASE
       RELEASE ALL
       RETURN
  CASE CMSELECT = 1
       DO CHG-MODEL
  CASE CMSELECT = 2
       DO CHG-OFFICE
  CASE CMSELECT = 3
       DO CHG-REP
  CASE CMSELECT = 4
       DO CHG-PRO
```

```
  CASE CMSELECT = 5
       DO CHG-FI
  CASE CMSELECT = 6
     DO CHG-EL
  CASE CMSELECT = 7
     DO CHG-FE
  CASE CMSELECT = 8
     DO CHG-AL
  CASE CMSELECT = 9
    DO CHG-CAT
* error message if wrong number pushed by user
  OTHERWISE
    ERASE
    20,3 SAY Please enter values between 0 and 9 only
    21,3 SAY Please try again
ENDCASE
ENDDO
RETURN


* Program   CHG-FILE
*
* purpose: to permit user to change a file type record
*
* programmer: al noel
*
* files used: file, ifile, inputs, outputs
*
* programs called: afiimod, dfiimod, afiomod, dfiomod
set exact on
SET FORMAT TO SCREEN
SET COLOR TO 30,14
SET TALK OFF
ERASE
REMARK STANDBY PLEASE...
USE FILE   INDEX IFILE
* set up loop to do work
STORE t TO cmmore
DO WHILE CMMORE
   ERASE
   ?
   ?
accept Enter the unique name of the File   you wish to change  TO CMNUM
   ERASE
* look for record with unique name given by user
FIND &CMNUM
* if cant find record with unique name, tell user
```

```
IF
 = 0
   ERASE
    ?
    ?
   ? A Record with File   named     , CMNUM,  is not in the file
ACCEPT Enter a Y to try again or N if not and then hit RETURN to cmansw
* check if user wants to try again or quit program
   IF CMANSW <> Y .AND. CMANSW <> y
      STORE F TO CMMCRE
   ENDIF
ELSE
      * store file data into memory variables
      store fname to oldfname
      store fname to amfname
      store fullname to amfullname
      store purpose to ampurpose
      store descrip to amdescrip
      store status to amstatus
      store seclass to amseclass
      store poc      to ampoc
      store media  to ammedia
      store lstupdat to amlstupdat
* set up screen for user to edit data
set format to fidat

READ
*  replace data in file with edited data from screen
   REPLACE fname  with !(amfname) , fullname with     !(amfullname )
   REPLACE purpose WITH !(ampurpose), descrip with !(amdescrip)
   REPLACE poc       WITH !(ampoc     ), status  WITH !(ampoc     )
   replace seclass with !(amseclass), media  with !(ammedia )
   replace lstupdat with amlstupdat
* if unique name of file changed, change associate files of inputs& outputs
   if    !(amfname)    <> oldfname
      ERASE
      14,3 SAY 'STANDBY PLEASE...'
      use inputs
      do while .not. eof
         if TRIM(ename) =TRIM( oldfname)  .and. ETYPE = 'FILE'
            replace ename with !(amfname)
         endif
         skip
      enddo
     use outputs

      do while .not. eof
         if TRIM(ENAME) = TRIM(oldfname) .and.  etype = 'FILE'
```

```
            replace ename  with !(amfname)
          endif
          skip
      enddo
* if new unique name of file, then change in contains file
      use contains
      do while .not. eof
         if trim(ename1) = trim(oldfname) .and. trim(etype1) = 'FILE'
            replace ename1 with !(amfname)
         endif
         skip
      enddo
endif
      ERASE
* check if user needs to add models that input from this file
      ? Do you need to add new models that inputs this file?
    accept  If so, hit Y and RETURN, else hit space bar and RETURN to answer
    if 'Y' = !(answer)
      ERASE
      do afiimod
    endif
erase
?
?
? 'Do you wish to delete a Model that inputs  this file      ? '
accept 'If so enter a Y and RETURN, else hit the space bar and RETURN' to answr
* check of see if user needs to delete from inputs file models that input file
if 'Y' = !(answr)
      erase
      do dfiimod
endif
erase
?
?
? 'Do you wish to add a Model that outputs this file ?'
accept ' If so enter an Y and RETURN, else hit space bar and RETURN' TO ANSWR
* check if user wants to add outputs record that model outputs this file
IF 'Y' = !(ANSWR)
   ERASE
   DO AFIOMOD
ENDIF
erase
?
?
? 'Do you wish to delete a Model that outputs this file   ?'
*check if user wants to delete a model from outputs file for edited file
accept 'If so enter a Y and RETURN, else hit the space bar and RETURN' to answr
if 'Y' = !(answr)
```

```
    erase
    do dfiomod
endif
      ERASE
      ?
      ?
      ?
* prompt user for choice to change another record or to leave pgm
      ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER FILE   TO CMCONT
      ERASE
      IF CMCONT <> y  .AND. CMCCNT <> Y
         ERASE
         STORE F TO CMMORE
      ELSE
         USE FILE   INDEX IFILE
      ENDIF
   ENDIF

*END OF DO WHILE
ENDDO
ERASE
RELEASE ALL
RETURN
```



```
* afiimod.prg
*
* purpose: to add model to inputs file for a preexising file
*
* programmer: al noe
*
* files used: inputs
ERASE
?
?
accept 'Enter unique name of Model and hit RETURN' to mod
use inputs
append blank
replace ename1 with !(mod) , etype1 with 'MODEL'
replace ename with !(amfname), etype with 'FILE'
erase
return

* dfiimod.prg  delete models in inputs file that use     a preexsisting file
```

```
*
* purpose: delete models inputs file that no longer input from preexisting file
*
* programmer: al noel
*
* files used: inputs
*
erase
?
?
accept 'Enter the unique name of the Model and hit RETURN' to mod
erase
 14,3 say 'Standby ...'
use inputs
store !(amfname) to amfname
store !(mod) to mod
do while  .not. eof
if TRIM(ename1) = TRIM(mod) .and. TRIM(etype1) = 'MODEL'   .
        .and. trim(ename) = trim(amfname) .and. etype = 'FILE'
      delete
   endif
   skip
enddo
pack
return
* afiomod.prg to add model that outputs a preexisting file
*
* purpose: to add model that outputs a preexisting  file
*
* programmer: al noel
*
*  files used: outputs
?
?
accept 'Enter unique name of Model and hit RETURN' to mod
use outputs
append blank
replace ename1 with !(mod)  , etype1 with 'MODEL'
replace ename with !(amfname), etype with 'FILE'
erase
return

* dfiomod.prg  delete models in output file that produce a preexsisting file
*
* purpose: delete models in output file that produce a preexisting file
*
* programmer: al noel
*
```

```
* files used: outputs
*
erase
?
?
accept 'Enter the unique name of the Model and hit RETURN' to mod
erase
 14,3 say 'Standby ...'
use outputs
store !(amfname) to amfname
store !(mod) to mod
do while  .not. eof
if  trim(ename1) = trim(mod) .and. trim(etype1) = 'MODEL'.and.  ;
        trim(ename) = trim(amfname) .and. trim(etype)= 'FILE'
      delete
   endif
   skip
enddo
pack
return
* Program   CHG-FIELD
*
* purpose: to change field record
*
* programmer: al noel
*
* files used: field, ifield
*
* programs called:  afeel, dfeel
*
set exact on
SET FORMAT TO SCREEN
SET COLOR TO 30,14
SET TALK OFF
ERASE
REMARK STANDBY PLEASE ...
USE FIELD   INDEX IFIELD
* set up loop to do work
STORE t TO cmmore
DO WHILE CMMORE
   ERASE
   ?
   ?
accept Enter the unique name of the Field   you wish to change to CMNUM
   ERASE
* locate record with unique name given by user
FIND &CMNUM
* if no find, tell user and allow to quit or not
```

```
IF
 = 0
   ERASE
    ?
    ?
   ? A Record with Field   named      , CMNUM, is not in the file
ACCEPT Enter a Y to try again or N if not and then hit RETURN to cmansw
   IF CMANSW <> Y .AND. CMANSW <> y
      STORE F TO CMMORE
   ENDIF
ELSE
      * store file data into memory variables
      store fld     to oldfld
      store fld     to amfld
      store length    to amlength
      store datatype to amdatatype
      store nullstat to amnullstat
      store source to amsource
      store domain to amdomain
      store purpose to ampurpose
      store descrip to amdescrip
      store status to amstatus
      store seclass to amseclass
      store poc to ampoc
* set up screen for user to edit data
set format to fedat

READ
*  replace data in file with data from screen
   REPLACE fld     with !(amfld    ), length    with      !(amlength   )
   REPLACE datatype WITH !(amdatatype), nullstat with !(amnullstat)
   REPLACE source   WITH !(amsource  ), domain  WITH !(amdomain )
   replace purpose with !(ampurpose), descrip      with !(amdescrip)
   replace status with !(amstatus), poc with !(ampoc), seclass with!(amseclass)
   * if new unique name for field, then change that in contains file
   if  amfld     <> oldfld
       ERASE
      14,3  SAY 'STANDBY PLEASE...'
      use contains
      do while .not. eof
         if TRIM(ename) = TRIM(oldfld) .and. trim(etype) =           'FIELD'
            replace ename with !(amfld    )
         endif
         skip
      enddo
endif
    ERASE
    ? Do you need to add new elements that contain this field   ?
```

```
    * check if user needs to add new elements to contains file for this field
   accept  If so, hit Y and RETURN, else hit space bar and RETURN to answer
   if 'Y' = !(answer)
    ERASE
    do afeel
   endif
   ERASE
?
*  check if user needs to delete from contains file for this particular field
accept 'Delete elements  which no longer contain this field ?,Y or space' to an
if 'Y' = !(an )
   erase
   do dfeel
endif
      ERASE
      ?
      ?
      ?
* prompt user for choice to change another record or to leave pgm
      ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER FIELD   TO CMCONT
      ERASE
      IF CMCONT <> y  .AND. CMCCNT <> Y
         ERASE
         STORE F TO CMMORE
      ELSE
         USE FIELD   INDEX IFIELD
      ENDIF
   ENDIF

*END OF DO WHILE
ENDDO
ERASE
RELEASE ALL
RETURN
```



```
* afeel.prg     to add elements (containers) of fields that preexist
*
* purpose: to add elements(containers) of fields that preexist
*
* programmer: al noel
*
* files used: contains
*
```

```
store t to offlag
do while offlag
   ERASE
   ?
   ?
   ? Enter the name for the element containing this field and RETURN
   accept To quit entering elements hit the space bar and RETURN to amoff
    * check to quit or not
   if amoff =    .or. amoff = '  ' .or. amoff = '    '
      store f to offlag
      erase
      return
   else
     * put new record in contains file for field and element given by user
     use contains
     append blank
     replace ename1 with !(amoff), etype1 with  'ELEMENT'
     replace ename with !(amfld), etype with 'FIELD'
   ENDIF
ENDDO WHILE OFFLAG
* dfeel.prg
*
* purpose: to remove records from contains file where element containing
*          a field should no longer bekep as containing the field
*
* programmer: al noel
*
* files used: contains
*
store t to flag
do while flag
erase
?
? 'Enter name  for element no longer containing  this Field  and RETURN'
accept 'To quit deleting elements hit  space bar  and RETURN' to amoff
* check to quit or continue on
if amoff = ' ' .or. amoff = '  ' .or. amoff = '    '
   store f to flag
   use contains
   pack
   erase
   return
else
   erase
    14,3 say 'Standby please...  '
   * delete all records that meet criteria
   use contains
   do while .not. eof
```

```
        if trim(ename) = trim(amfld)  .and. trim(etype) = 'FIELD' .and. ;
                   trim(ename1) = !(amoff)
           delete
        endif
        skip
     enddo
  endif
  enddo while flag

  * Program   CHG-MODEL
  *
  * purpose: to permit user to change record for a model
  *
  * programmer: al noel
  *
  * files used: model, imodel,
  *
  * programs called: adoff, doff, admain, dmain
  *
  set exact on
  SET FORMAT TO SCREEN
  SET COLOR TO 30,14
  SET TALK OFF
  ERASE
   7,7 SAY BE PATIENT...
  USE MODEL INDEX IMODEL
  *set up loop to do work
  STORE t TO cmmore
  DO WHILE CMMORE
     ERASE
     ?
     ?
  accept Enter the unique name of the Model you wish to change  TO CMNUM
     ERASE
  * locate record for unique name given by  user
  FIND &CMNUM
  * if no find, tell user and ask if wasnt to continue or quit program
  IF
   = 0
     ERASE
      ?
      ?
     ? A Record with Model name     , CMNUM,  is not in the file
  ACCEPT Enter a Y to try again or N if not and then hit RETURN to cmansw
     IF CMANSW <> Y .ANL. CMANSW <> y
        STORE F TO CMMCRE
     ENDIF
  ELSE
```

```
* store file data into memory variables for editing in screen
      store mdl to oldmdl
      store mdl      to cmdl
      store modname to cmmodname
      store method to cmethod
      store status to cmstatus
      STORE location TO Cmlocation
      STORE purpose  TO CMpurpose
      store descrip to cmdescrip
      store runame to cmruname
      store period to cmperiod
* put up screen for user to edit data
 2, 1 SAY Unique name of Model get cmdl
 4, 1 SAY  Full name of model get cmmodname
 6, 1 SAY Methodology used get cmethod
 8, 1 SAY Status   get  cmstatus
10, 1 SAY Location    get cmlocation
12,1 say Purpose get cmpurpose
14,1 say Description get cmdescrip
16,1 say Runstream get cmruname
18,1 say Periodicity get cmperiod

READ
* replace data in file with edited data from screen
   REPLACE     mdl      WITH !(CMdl), modname with      !(cmmodname)
   REPLACE method WITH !(Cmethod), status with !(cmstatus)
   REPLACE location WITH !(Cmlocation), purpose WITH !(cmpurpose)
   replace descrip with !(cmdescrip), runame with !(cmruname)
   replace period with !(cmperiod)
   * if unique name was changed, then change uses, maintains, inputs, outputs
   * to new unique name
   if !(cmdl) <> oldmdl
      ERASE
      14,3  SAY 'STANDBY PLEASE...'
      use uses
      do while .not. eof
         if ename = oldmdl
            replace ename with !(cmdl)
         endif
         skip
      enddo
     use maintains
     do while .not. eof
        if mdl = oldmdl
           replace mdl with !(cmdl)
        endif
        skip
    enddo
```

```
      use calls
      do while .not. eof
          if trim(ename1) = TRIM(cldmdl) .and. trim(etype1) = 'MODEL'
             replace ename1 with !(cmdl)
          endif
          skip
      enddo
      use outputs
      do while .not. eof
        if trim(ename1) = trim(oldmdl) .and. trim(etype1) = 'MODEL'
           replace ename1 with !(cmdl)
        endif
        skip
      enddo
      use inputs
      do while .not. eof
      if trim(ename1) = trim(oldmdl) .and. trim(etype1) = 'MODEL'
        replace ename1 with !(cmdl)
       endif
       skip
    enddo
endif
     erase
     ? Do you need to add new users of this Model ?
   accept  If so, hit Y and RETURN, else hit space bar and RETURN to answer
*check if user needs to add new users of model to uses file
   if 'Y' = !(answer)
    ERASE
    do adoff
   endif
   erase
?
accept 'Do you wish to delete any users, Y or N' to answer
* check if user needs to delete users of model
if 'Y' = !(answer)
   erase
   do doff
endif
  erase
* check if needs to add new maintaiers of model
  ? Do you need to add new maintainers of this Model ?
 accept  If so, hit Y and RETURN, else hit space bar and RETURN to answer
   if 'Y' = !(answer)
    ERASE
    do admain
   endif
ERASE
?
```

```
?
? 'Do you need to delete any maintainers of this Model?'
*check if user needs to delete maintainers of model
accept 'If so, hit Y and RETURN, else hit space bar and RETURN' to answer
    if 'Y' = !(answer)
      erase
       do dmain
    endif
      ERASE
      ?
      ?
* prompt user for choice to change another record or to leave pgm
      ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER MODEL  TO CMCONT
      ERASE
      IF CMCONT <> y  .AND. CMCCNT <> Y
         ERASE
         STORE F TO CMMORE
      ELSE
         USE MODEL INDEX IMODEL
      ENDIF
   ENDIF

*END OF DO WHILE
ENDDO
ERASE
CLEAR
RELEASE ALL
RETURN
```



```
* program: adoff.prg
*
* purpose: to add offices that use an existing model
*
* programmer: al noel
*
* files used: uses
*
store t to offlag
do while offlag
   ? Enter the symbol for the office using this model and RETURN
   accept To quit entering offices hit the space bar and RETURN to amoff
   if amoff =    .or. amoff = '  ' .or. amoff = '   '
      store f to offlag
```

```
      erase
      return
   else
     use  uses
     append blank
     replace ofc with !(amoff), ename with !(cmdl), etype with 'MODEL'
     erase
   ENDIF
ENDDO WHILE OFFLAG
* program: doff.prg
*
* purpose: to delete offices from uses file that no longer use existing model
*
*programmer: al noel
*
*files used: uses
store t to flag
do while flag
?
? 'Enter symbol for office no longer using this Model and RETURN'
accept 'To quit  deleting users hit  space bar and RETURN' to amoff
* check if user wishes to quit or continue
if amoff = ' ' .or. amoff = '  ' .or. amoff = '   '
   store f to flag
   use uses
   * actually remove records from uses file
   pack
   erase
   return
else
   erase
    14,3 say 'Standby please...  '
   * mark records for deletion if are of model being changed and office given
   * by user to delete
   use uses
   do while .not. eof
      if ename = cmdl .and. ofc = amoff  .and. etype = 'MODEL'
         delete
      endif
      skip
  enddo
endif
enddo while flag

* program ADMAIN.PRG
*
* purpose: to add new maintainers (offices) of an existing model
*
```

```
* programmer: al noel
*
* files used: maintains
*
store t to flag
do while flag
 ? 'Enter office symbol for office maintaining this model and RETURN'
accept 'To quit entering maintainers hit space bar and RETURN' TO AMOFF
* check if user wants to quit or continue
IF AMOFF = ' ' .OR. AMOFF = '  ' .OR. AMOFF = '   '
   STORE F TO FLAG
   ERASE
   RETURN
ELSE
   ACCEPT 'Who is the point of contact ?' to ampoc
   * create new record and put in name given by user and model that was edited
   use maintains
   append blank
   replace ofc with !(amoff) , mdl with !(cmdl)
   replace modelpoc with !(ampoc)
   erase
endif
enddo while flag
* program:   dmain.prg
*
* purpose: to delete maintainers(offices) for an existing model
*
* programmer: al noel
*
* files used: maintains
*
* set up loop to do work
store t to flag
do while flag
erase
?
? 'Enter symbol for office no longer maintaining  this Model and RETURN'
accept 'To quit deleting maintainers hit  space bar and RETURN' to amoff
*check to quit or continue work
if amoff = ' ' .or. amoff = '  ' .or. amoff = '   '
   store f to flag
   use maintains
   * actually remove records marked for deletion
   pack
   erase
   return
else
   erase
```

```
      14,3 say 'Standby please...  '
    use maintains
*    mark for delettion records of model edited and for office given by user
    do while .not. eof
       if mdl   = cmdl .and. ofc = amoff
          delete
       endif
       skip
  enddo
endif
enddo while flag

* Program   CHG-ELEMENT
*
* purpose: to permit user to change record about an existing element
*
* programmer: al noel
*
* files used: element, ielement, contains
*
* programs called: aefil, defil
*
set exact on
SET FORMAT TO SCREEN
SET COLOR TO 30,14
SET TALK OFF
ERASE
REMARK STANDBY PLEASE ...
USE ELEMENT INDEX IELEMENT
* set up loop to do work
STORE t TO cmmore
DO WHILE CMMORE
   ERASE
   ?
   ?
accept Enter the unique name of the Element you wish to change to CMNUM
   ERASE
* locate record for unique name given by user
FIND &CMNUM
* if no find, tell user and ask if he wishes to continue
IF
 = 0
   ERASE
    ?
    ?
   ? A Record with Element named     , CMNUM,  is not in the file
ACCEPT Enter a Y to try again or N if not and then hit RETURN to cmansw
* check if wishes to quit or continue
```

```
   IF CMANSW <> Y .AND. CMANSW <> y
     STORE F TO CMMORE
   ENDIF
ELSE
      * store file data into memory variables so user can edit it
      store elname to oldelname
      store elname to amelname
      store version  to amversion
      store date to amdate
      store seqnum  to amseqnum
      store size    to amsize
      store poc     to ampoc
      store purpose to ampurpose
      store descrip to amdescrip
* set up screen
set format to eldat

READ
   * replace file data with edited data from screen
   REPLACE elname with !(amelname), version  with     !(amversion )
   REPLACE date    WITH !(amdate   ), seqnum  with !(amseqnum )
   REPLACE size     WITH !(amsize    ), poc     WITH !(ampoc    )
   replace                          descrip      with !(amdescrip)
   * if unique name changed , then make changes in contains file
   if !( amelname)<> oldelname
     ERASE
      14,3  SAY 'STANDBY PLEASE...'
      use contains
      do while .not. eof
         if ename = oldelname                .and. etype = 'ELEMENT'
            replace ename with !(amelname)
         endif
         skip
      enddo
     use contains
     do while .not. eof
        if trim(ename1) = TRIM(oldelname) .and. trim(etype1) = 'ELEMENT'
           replace ename1 with !(amelname)
       endif
       skip
    enddo
endif
ERASE
    ? Do you need to add new files  that contain this element ?
* check if user needs to new files containing the element
   accept  If so, hit Y and RETURN, else hit space bar and RETURN to answer
   if 'Y' = !(answer)
    ERASE
```

```
     do aefil
   endif
?
?
ERASE
accept 'Delete file which no longer contain this element  ?, Y or space' to ans
* check if user needs to delete files from contains that no longer contain
* element
if 'Y' = !(ans   )
   erase
   do defil
endif
      ERASE
      ?
      ?
      ?
* prompt user for choice to change another record or to leave pgm
      ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER ELEMENT TO CMCONT
      ERASE
      IF CMCONT <> y  .AND. CMCONT <> Y
         ERASE
         STORE F TO CMMORE
      ELSE
         USE ELEMENT INDEX IELEMENT
      ENDIF
   ENDIF

*END OF DO WHILE
ENDDO
ERASE
RELEASE ALL
RETURN



* program: aefil.prg
*
* purpose: to add files (containers) for elements that preexist
*
* programmer: al noel
*
* files used: contains
*
* set up loop to do work
store t to offlag
```

```
do while offlag
   ERASE
   ?
   ?
   ? Enter the name for the file containing  this elememt and RETURN
   accept To quit entering files   hit the space bar and RETURN to amoff
   * check if user wants to quit or continue
   if amoff =    .or. amoff = '  ' .or. amoff = '    '
      store f to offlag
      erase
      return
   else
     * create new record and load with file given and element changed
     use  contains
     append blank
     replace ename1 with !(amoff), etype1 with FILE, ename with !(amelname)
     replace etype with ELEMENT
   ENDIF
ENDDO WHILE OFFLAG
* program: defil.prg
*
* purpose: to delete files from contains file that no longer contain an element
*
* programmer: al noel
*
* files used: contains
*
store t to flag
do while flag
erase
?
? 'Enter name  for file no longer containing this element and RETURN'
accept 'To quit  deleting files hit  space bar and RETURN' to amoff
* check if user wants to quit or continue
if amoff = ' '  .or. amoff = '  ' .or. amoff = '    '
   store f to flag
   use contains
   * actually remove records marked for deletion
   pack
   erase
   return
else
   erase
    14,3 say 'Standby please...  '
   * mark for deletion records with file given and element changed
   use contains
   do while .not. eof
      if ename = amelname .and. etype ='ELEMENT'.and. ename1 =!(amoff)
```

```
            delete
         endif
         skip
      enddo
   endif
   enddo while flag

   * Program CHG-CATEGORY.PRG
   *
   * purpose: to change an existing category record
   *
   * programmer: al noel
   *
   * files used: category, icategory
   *
   SET FORMAT TO SCREEN
   * set color to yellow and blue
   SET COLOR TO 30,14
    SET TALK OFF
   ERASE
   REMARK STANDBY PLEASE ...
   USE CATEGORY INDEX ICATEGORY
   * set up loop to do work
   STORE T TO COMORE
    DO WHILE COMORE
      ERASE
        ?
        ?
        ACCEPT ENTER THE UNIQUE NAME OF   THE RECORD TO BE CHANGED TO PART1
        ACCEPT ENTER THE TYPE OF ENTITY  TO PART2
        STORE PART1 - PART2 TO  KEY
        ERASE
      * locate record with unique names given by user
      FIND &KEY
      * if record cant be located, tell user
      IF
    = 0
         ERASE
         ?
         ?  A RECORD WITH NAME ,      PART1, OF TYPE: ,PART2, 'NOT IN THE FILE'
         ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN  TO COANSW
         IF COANSW <> Y .AND. COANSW <> y
            store f to comore
         endif
      else
         * store file data in memory variable
         STORE ENAME TO AMENAME
         STORE ETYPE   TO AMETYPE
```

```
      STORE CAT     TO AMCAT
* set up screen for user to use
SET FORMAT TO CATDAT

READ
   * replace data in file with edited data from screen
   REPLACE ENAME WITH !(AMENAME), ETYPE    WITH !(AMETYPE)
   REPLACE CAT    WITH !(AMCAT   )
   ERASE
    ?
    ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER RECORD TO COCONT
    ERASE
   IF COCONT <> Y .AND. COCONT <> y
      ERASE
      STORE F TO COMORE
   ENDIF
ENDIF
 ENDDO
 ERASE
RELEASE ALL
RETURN
```



```
* Program   CHG-REPORT
*
* purpose: to change record about an existing report
*
* programmer: al noel
*
* files used: report, ireport, cutputs, uses
*
* programs called; aruse, druse, arout, drout
*
set exact on
SET FORMAT TO SCREEN
SET COLOR TO 30,14
SET TALK OFF
ERASE
USE REPORT INDEX IREPORT
* set up loop to do work
STORE t TO cmmore
DO WHILE CMMORE
```

```
   ERASE
   ?
   ?
accept Enter the unique name of the Report you wish to change  TO CMNUM
   ERASE
* locate record for unique name given by user
FIND &CMNUM
* if no find, tell user and ask if wants to quit
IF
 = 0
   ERASE
    ?
    ?
   ? A Record with Report named     , CMNUM,  is not in the file
ACCEPT Enter a Y to try again or N if not and then hit RETURN to cmansw
* checkif user wants to quit
   IF CMANSW <> Y .AND. CMANSW <> y
      STORE F TO CMMORE
   ENDIF
ELSE
* store file data into memory variables for screen editing
      store rname to oldrname
      store rname to crname
      store fullname to cfullname
      store purpose to cpurpose
      store descrip to cdescrip
      store number to cnumber
      store status to cstatus
      store seclass to cseclass
      store outfrmat to coutfrmat
      store period to cperiod
* put data up on screen for user to edit it
 2,  1 SAY Unique name of Report get crname
 4,1  SAY  Full name of Report get cfullname
 6,  1 SAY Purpose get cpurpose
 8,  1 SAY Description get cdescrip
 10,  1 SAY Number      get cnumber
 12,1 say Status  get cstatus
 14,1 say Security classification get cseclass
 16,1 say Output format get coutfrmat
 18,1 say Periodicity get cpericd

READ
   * replace data in file with edited data from screen
   REPLACE rname  with !(crname)   , fullname with     !(cfullname)
   REPLACE purpose WITH !(cpurpose), descrip with !(cdescrip)
   REPLACE number   WITH !(Cnumber  ), status  WITH !(cstatus  )
   replace seclass with !(cseclass ), period with !(cperiod )
```

```
   * if unique name changed, change uses and outputs files accordingly
   if crname <> oldrname
       ERASE
      14,3 SAY 'STANDBY PLEASE...'
      use uses
      do while .not. eof
         if ename = oldrname  .and. etype = 'REPORT'
            replace ename with !(crname )
         endif
         skip
      enddo
     use outputs
     do while .not. eof
        if ename = oldrname .and.  etype = 'REPORT'
           replace ename  with !(crname)
        endif
        skip
     enddo
endif
     ERASE
     ? Do you need to add new users of this Report ?
   * check if new uses records to be added to uses file
   accept  If so, hit Y and RETURN, else hit space bar and RETURN to answer
   if 'Y' = !(answer)
     ERASE
     do aruse
   endif
?
?
erase
* check to delete users (offices) of the report edited
accept 'Do you wish to delete any users, Y or N' to answer
if 'Y' = !(answer)
   erase
   do druse
endif
erase
?
?
? 'Do you wish to add a Model that outputs this report ? '
* check to see if new models output the report
accept 'If so enter a Y and RETURN, else hit the space bar and RETURN' to answr
if 'Y' = !(answr)
     erase
     do arout
endif
erase
?
```

```
?
* check to delete models from outputs file that used to output file
? 'Do you wish to delete a Model that outputs this report ?'
accept 'If so enter a Y and RETURN, else hit the space bar and RETURN' to answr
if 'Y' = !(answr)
    erase
    do drout
endif
      ERASE
      ?
      ?
      ?
* prompt user for choice to change another record or to leave pgm
      ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER REPORT TO CMCONT
      ERASE
      IF CMCONT <> y  .AND. CMCCNT <> Y
         ERASE
         STORE F TO CMMORE
      ELSE
         USE REPORT INDEX IREPORT
      ENDIF
   ENDIF

*END OF DO WHILE
ENDDO
ERASE
RELEASE ALL
RETURN
```

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```
* program adruse.prg
*
* purpose: to add users (offices) in uses file for reports that preexist
*
* programmer: al noel
*
* files used: uses
*
store t to offlag
do while offlag
   ERASE
   ?
   ?
   ? Enter the symbol for the office using this report and RETURN
```

```
   accept To quit entering offices hit the space bar and RETURN to amoff
   * check if user wants to quit or not
   if amoff =    .or. amoff = '  ' .or. amoff = '    '
      store f to offlag
      erase
      return
   else
     use  uses
     * put in new  record
     append blank
     replace ofc with !(amoff), ename with !(crname), etype with 'REPORT'
   ENDIF
ENDDO WHILE OFFLAG
* program: druse.prg
*
* purpose: to delete users of a report
*
* programmer: al noel
*
* files used: uses
store t to flag
* set up loop to do work
do while flag
erase
?
? 'Enter symbol for office no longer using this Report and RETURN'
accept 'To quit  deleting users hit  space bar and RETURN' to amoff
* check if user wants to quit or not
if amoff = ' ' .or. amoff = '  ' .or. amoff = '    '
   store f to flag
   use uses
   * actually remove records marked for deletion
   pack
   erase
   return
else
   erase
    14,3 say 'Standby please...  '
   * mark records for delettion for report edited and office given by user
   use uses
   do while .not. eof
      if ename = crname .and. ofc = amoff
         delete
      endif
      skip
  enddo
endif
enddo while flag
```

```
* program arout.prg   to add model that outputs a preexisting report
*
* purpose: to add model to outputs file for a preexisting report
*
* programmer: al noel
*
* files used: outputs
?
?
accept 'Enter unique name of Model and hit RETURN' to mod
*create new blank record and load with report edited and model given by user
use outputs
append blank
replace ename1 with !(mod) , etype1 with 'MODEL'
replace ename with !(crname) , etype with 'REPORT'
erase
return

* program:  drout.prg
*
* purpose: to delete models in output file that produce a preexisting report
*
* programmer; al noel
*
* files  used: outputs
erase
?
?
accept 'Enter the unique name of the Model and hit RETURN' to mod
erase
 14,3 say 'Standby ...'
use outputs
store !(crname) to crname
store !(mod) to mod
* mark records for report edited and model given by user
do while .not. eof
if ename1 = mod .and. etype1 = 'MODEL'.and. ename = crname .and.etype='REPORT'
        delete
   endif
   skip
enddo
use outputs
* actually remove records marked for deletion
pack
return
* Progam CHG-OFFICE
*
```

```
* purpose: to permit user to change an office record
*
* programmer: al noel
*
* files used: office, ioffice, uses , maintains
*
set exact on
SET FORMAT TO SCREEN
* set color to yellow and blue
SET COLOR TO 30,14
 SET TALK OFF
ERASE
REMARK STANDBY PLEASE...
USE OFFICE INDEX IOFFICE
STORE T TO COMORE
 DO WHILE COMORE
   ERASE
      ?
      ?
      ?
      ACCEPT ENTER THE OFFICE SYMBOL OF THE RECORD TO BE CHANGED TO   KEY
      ERASE
   * find record in file based upon what user gave just above
   FIND &KEY
   * tell user there was no finding of record for symbol he gave
   IF
 = 0
       ERASE
       ?
       ?
       ?
       ?  A RECORD WITH THE SYMBOL KEY, NOT IN THE FILE
       ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN  TO COANSW
       * check to quit or try again
       IF COANSW <> Y .AND. COANSW <> y
          store f to comore
       endif
   else
       * store field variables to memory variable for editing
       STORE OFC TO OLDOFC
       STORE OFC   TO COFC
       STORE ONAME   TO CONAME
       STORE BLDG   TO CBLDG
       STORE ROOM  TO CROOM
       STORE PHONE  TO CPHONE
       STORE COMMENTS TO CCOMMENTS
       STORE POC  TO CPOC
* put up screen for user to edit data
```

```
 1,1 SAY OFFICE SYMBOL GET COFC
 3,1 SAY OFFICE NAME   GET CONAME
 5,1 SAY BUILDING    GET CBLDG
 7,1  SAY ROOM NUMBER GET CROOM
 9,1 say PHONE GET CPHONE
11,1 SAY COMMENTS GET CCOMMENTS
13,1 SAY POINT OF CONTACT GET CPOC

READ
   * replace data in file record with data from screen
   REPLACE ONAME WITH !(CONAME)  , OFC     WITH !(COFC)
   REPLACE BLDG   WITH !(CBLDG   ), ROOM WITH !(CROOM), PHONE   WITH !(CPHONE )
   REPLACE COMMENTS WITH  !( CCOMMENTS),          POC  WITH  !( CPOC  )
   * if new unique name for office then change associate intersection records
   * in uses and maintains files
   IF !(COFC) <>  OLDOFC
       ERASE
       14,7 SAY 'STAND BY PLEASE ...'
       USE USES
       DO WHILE .NOT. EOF
          IF  TRIM(OFC) = TRIM(OLDOFC)
             REPLACE OFC WITH !(COFC)
          ENDIF
          SKIP
       ENDDO
       USE MAINTAINS
       DO WHILE .NOT. EOF
          IF TRIM(OFC) = TRIM(OIDOFC)
             REPLACE OFC WITH !(COFC)
          ENDIF
          SKIP
       ENDDO
   ENDIF
   ERASE
    ?
    ?
    * check if user wants to change another record
    ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER RECORD TO COCONT
    ERASE
   IF COCONT <> Y .AND. COCONT <> y
      ERASE
      STORE F TO COMORE
   ELSE
      USE OFFICE INDEX IOFFICE
   ENDIF
ENDIF
 ENDDO
 ERASE
```

```
CLEAR
RELEASE ALL
RETURN

* Progam CHG-ALIAS
*
* purpose: to change an existing alias record
*
* programmer: al noel
*
* files used; alias, ialias
*
set exact on
SET FORMAT TO SCREEN
* set color to yellow and blue
SET COLOR TO 30,14
 SET TALK OFF
ERASE
REMARK STANDBY PLEASE...
USE ALIAS  INDEX IALIAS
* set up loop to do work
STORE T TO COMORE
 DO WHILE COMORE
   ERASE
      ?
      ?
      ?
      ?
      ?
* BUILD SEARCH KEY AND THEN GO FIND RECORD YOU WANT
      ACCEPT ENTER THE UNIQUE NAME OF   THE RECORD TO BE CHANGED TO PART1
      ACCEPT ENTER THE ALIAS OF THE ENTITY TO PART2
      STORE PART1 - PART2 TO  KEY
      ERASE
* find the unique record the user wants, a concatenated string
   FIND &KEY
*if record can't be found, tell user
   IF
 = 0
       ERASE
       ?
       ?
       ?
       ?

       ?  A RECORD WITH NAME ,      PART1, OF TYPE: ,PART2, 'NOT IN THE FILE'
       ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN  TO COANSW
```

```
         * check if user wants to try again
         IF COANSW <> Y .AND. COANSW <> y
            store f to comore
         endif
      else
         * store file data into memory variables
         STORE ENAME TO AMENAME
         STORE ANAME   TO AMANAME
         STORE ETYPE  TO AMETYPE
   * put up screen so user can edit data
   SET FORMAT TO ALDAT

   READ
      * replace data in record with data from screen user has edited
      REPLACE ENAME WITH !(AMENAME), ANAME   WITH !(AMANAME)
      REPLACE ETYPE  WITH !(AMETYPE)
      ERASE
       ?
       ?
       ?
       ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER RECORD TO COCONT
       ERASE
      * check if user wants to change another record
      IF COCONT <> Y .AND. COCONT <> y
         ERASE
         STORE F TO COMORE
      ENDIF
   ENDIF
    ENDDO
    ERASE
   RELEASE ALL
   RETURN


   * Program   CHG-PROGRAM
   *
   * purpose: to permit user to change a program record in the dictionary
   *
   * programmer: al noel
   *
   * files used: program, iprogram, calls
   *
   * programs called: apmod, dpmod
   set exact on
   SET FORMAT TO SCREEN
   SET COLOR TO 30,14
   SET TALK OFF
   ERASE
```

```
REMARK STANDBY PLEASE...
USE PROGRAM INDEX IPROGRAM
* set up loop to do work
STORE t TO cmmore
DO WHILE CMMORE
   ERASE
   ?
   ?
?      Enter the unique name of the Program you wish to change
accept Please string together Program name and version,i.e. UTRACS1 TO CMNUM
   ERASE
*  look for record with unique name given by user
FIND &CMNUM
*    if don't find record tell user and ask if wishes to   try again
IF
 = 0
   ERASE
    ?
    ?
   ? A Record with Program named     , CMNUM,  is not in the file
ACCEPT Enter a Y to try again or N if not and then hit RETURN to cmansw
   * check if user wants to try again
   IF CMANSW <> Y .AND. CMANSW <> y
      STORE F TO CMMORE
   ENDIF
ELSE
      * store data from file into memory variables for screen and editing
      store version to oldversion
      store pname to oldpname
      store pname to ampname
      store location to amlocation
      store language to amlanguage
      store version to amversion
      store purpose to ampurpose
      store descrip to amdescrip
      store status to amstatus
      store period  to amperiod
* put up screen for user to edit data
set format to prodat

READ
   * replace data in record with data from screen
   REPLACE pname  with !(ampname) , location with     !(amlocation)
   REPLACE version WITH !(amversion), purpose with !(ampurpose)
   REPLACE descrip  WITH !(amdescrip ), status  WITH !(amstatus )
   replace                          period with !(amperiod)
   * if unique name has been changed, go change intersection records
   if (ampname<> oldpname) .or. (amversion <> oldversion)
```

```
        ERASE
        14,3 'STANDBY PLEASE...'
        use calls
        do while .not. eof
           if ename = (oldpname-oldversion)  .and. etype = 'PROGRAM'
              store ampname-amversion to holder
              replace ename with !(holder )
           endif
           skip
        enddo
endif
     erase
     * check to add intersection records
     ? Do you need to add new models that call this program?
   accept  If so, hit Y and RETURN, else hit space bar and RETURN to answer
   if 'Y' = !(answer)
     ERASE
     do apmod
   endif
?
?
erase
* check to delete models from intersection file
accept 'Delete models which no longer call this program  ?, Y or space'  to ans
if 'Y' = !(ans    )
   erase
   do dpmod
endif
        ERASE
        ?
        ?
        ?
* prompt user for choice to change another record or to leave pgm
        ACCEPT ENTER A Y IF YOU WANT TO CHANGE ANOTHER PROGRAM TO CMCONT
        ERASE
        IF CMCONT <> y  .AND. CMCCNT <> Y
           ERASE
           STORE F TO CMMORE
        ELSE
           USE PROGRAM INDEX IPROGRAM
        ENDIF
   ENDIF

*END OF DO WHILE
ENDDO
ERASE
RELEASE ALL
RETURN
```

```
* apmod.prg    to add models in calls file for preexisting program records
*
* purpose: to add models in calls file for preexisting program records
*
* programmer: al noel
*
* files used: calls
*
store t to offlag
do while offlag
   ERASE
   ?
   ?
   ? Enter the unique name for the model calling this program and RETURN
   accept To quit entering models  hit the space bar and RETURN to amoff
   * check to quit
   if amoff =   .or. amoff = '  ' .or. amoff = '    '
      store f to offlag
      erase
      return
   else
      * create new blank record and load data from screen
      use calls
      append blank
      store ampname - amversion  to holder
      replace ename1  with !(amoff), etype1 with 'MODEL'
      replace ename with !(holder ), etype with  'PROGRAM'
    ENDIF
ENDDO WHILE OFFLAG
* dpmcd.prg
*
* purpose: to delete intersection records from calls file that are for models
*          that no longer call the program being changed in chg-pro
*
* programmer: al noel
*
* files used: calls
*
store t to flag
do while flag
erase
?
```

```
? 'Enter unique name for model no longer calling this program and RETURN'
accept 'To quit  deleting models hit  space bar and RETURN' to amoff
* check to quit
if amoff = ' ' .or. amoff = '  ' .or. amoff = '   '
   store f to flag
   use calls
   pack
   erase
   return
else
   erase
    14,3 say 'Standby please...  '
   * delete record from calls file for the program edited & model given by user
   use calls
   do while .not. eof
    STORE AMPNAME-AMVERSION TO X
    if TRIM(ename1) = TRIM(amoff) .and. etype1= 'MODEL'.and. ;
                  TRIM(ENAME) = TRIM(X)
         delete
      endif
      skip
  enddo
endif
enddo while flag
```


Format Files Used in CHANGE subsystem

CATDAT.FMT

```
 2,3 say    Entity's  unique name get amename
4,3 say      Type  get ametype
6,3   say    Category get  amcat
```

PRODAT.FMT

```
 2,3 say    Program's unique name get ampname

4,3 say      Location get amlocation
6,3   say    Version    get amversion
8,3 say      Status get amstatus
10,3 say      Purpose  get ampurpose
12,3 say      Description get amdescrip
14,3 say      Periodicity get amperiod
16,3 say Language get amlanguage
```

ALDAT.FMT

```
 2,3 say    Entity's  unique name get amename
```

```
4,3 say      Alias get amaname
6,3   say    Type of entity (i.e. MODEL, or REPORT) get ametype
```

FEDAT.FMT

```
 2,3 say    Field's  unique name   get amfld
4,3  say     Length of field in bytes  get amlength
6,3   say    Data type (A = alpha, N = numeric, S = special) get amdatatype
8,3 say      Null status ? (Y or N )   get amnullstat
10,3 say      Source        get  amsource
12,3 say      Domain   get amdcmain
14,3 say      Purpose  get ampurpose
16,3 say Description get amdescrip
18,3 say Status get amstatus
20,3  say Security classification (U,C,S,TS) get amseclass
22,3 say Point of contact get ampoc
```

FIDAT.FMT

```
 2,3 say    File's unique name    get amfname
4,3  say     File's  full name get amfullname
6,3   say    Storage media get ammedia
8,3 say      Status get amstatus
10,3 say      Purpose  get ampurpose
12,3 say      Description get amdescrip
14,3 say      Point of contact get ampoc
16,3 say Security classification get amseclass
18,3 SAY 'Date of last update' get amlstupdat
```

ELDAT.FMT

```
 2,3 say    Element's unique name get amelname
4,3  say     Version get   amversion
6,3   say    Date        get amdate
8,3 say      Sequence number get amseqnum
10,3 say      Size     get amsize
12,3 say      Point of Contact get ampoc
14,3 say      Purpose     get ampurpose
16,3 say Description get amdescrip

*  program name:  del-menu
*
*  purpose: to permit user to delete records from dictionary
*
* programmer: al noel
*
*
```

```
set color to 30,14
SET TALK OFF
ERASE
* set up loop for user to select specific function
DO WHILE T
   2,0
     TEXT
        This is the DELETE menu.  It permits you to delete records from any
        file. Please enter the number of the function you wish to perform.

                                   0 to quit

     1 Model (DEL-MODEL)                5 File (DEL-FI)
     2 Office (DEL-OFFICE)              6 Element (DEL-EL)
     3 Report (DEL-REP)                 7 Field (DEL-FE)
     4 Program (DEL-PRO)                8 Alias (DEL-AL)
                                        9 Category (DEL-CAT)

     Enter the selection here
  ENDTEXT
WAIT TO DMSELECT
 20,0   SAY
 21,0   SAY
* case statement for calling of program per users choice above
DO CASE
   CASE DMSELECT = 0
      USE
      RELEASE ALL
      ERASE
      RETURN
   CASE DMSELECT = 1
      DO DEL-MODEL
   CASE DMSELECT = 2
      DO DEL-OFFICE
   CASE DMSELECT = 3
     DO DEL-REP
   CASE DMSELECT = 4
     DO DEL-PRO
   CASE DMSELECT = 5
     DO DEL-FI
   CASE DMSELECT = 6
     DO DEL-EL
   CASE DMSELECT = 7
     DO DEL-FE
   CASE DMSELECT = 8
     DO DEL-AL
   CASE DMSELECT = 9
     DO DEL-CAT
```

```
   * error message if wrong number picked
   OTHERWISE
         ERASE
         20,3 SAY Please enter values between 0 and 9 only
         21,3 SAY Please try again
    ENDCASE
ENDDO
RETURN

* Program: name del-file
*
* purpose: to delete file record from dictionary
*
* programmer: al noel
*
* files used: file, ifile, outputs, inputs, contains
*
set exact on
SET FORMAT TO SCREEN
ERASE
SET COLOR TO 30,14
SET TALK OFF
*
store t to dmmore
* This starts a loop which runs the program until user wants to quit
do while dmmore
    erase
    use file    index ifile
   ?
   ?
ACCEPT ENTER THE FILE'S    UNIQUE NAME PLEASE TO DMNUM
ERASE
* This locates the exact record
  FIND &DMNUM
 IF
 = 0
   ?
   ?
   ?
  ? A FILE NAMED:     , DMNUM, IS NOT IN THE FILE, SORRY
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DMANSW
* This allows the user to make a mistake
   ERASE
   IF !(DMANSW) <> Y
     STORE F TO DMMORE
  ENDIF
ELSE
```

```
   store fname     to dmmodname
   store purpose   to dmmodelnum
 7,1 say THE FILE'S UNIQUE NAME IS:
 7,30 SAY DMMODNAME
  9,1 SAY THE FILE'S PURPOSE IS:
  9, 30 SAY DMMODELNUM
?
? ********** WARNING! ********** WARNING! ********* WARNING! ********
?
* This allows the user to insure they wish to proceed.
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion.
iF !(PROCEED) = Y
   ERASE
   14,8 SAY 'STANDBY PLEASE...'
   DELETE
   USE OUTPUTS
   DELETE ALL FOR    TRIM(ENAME) = TRIM(DMNUM) .AND. TRIM(ETYPE)= 'FILE'
   USE INPUTS
   DELETE ALL FOR TRIM(ENAME) = TRIM(DMNUM) .AND. TRIM(ETYPE) = 'FILE'
   USE CONTAINS
   DELETE ALL FOR TRIM(ENAME1) = TRIM(DMNUM) .AND. TRIM(ETYPE1) = 'FILE'
ENDIF
ERASE
  ?
  ?
* This allows the user to continue deleting records.
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF  DOAGI <> y .AND. DOAGI <> Y
      ERASE
      STORE F TO DMMORE
  ENDIF
  ENDIF
ENDDO
* The program is exited.
ERASE
REMARK STANDBY WHILE I PERFORM MAINTENANCE ON ASSOCIATED FILE...
* actually delete records marked for deletion above
 USE OUTPUTS
 PACK
 USE INPUTS
  PACK
 USE FILE
 PACK
 USE CONTAINS
 PACK
ERASE
```

```
RELEASE ALL
RETURN

* Program: name del-office
*
* purpose: to delete office records from dictonary
*
* programmer: al noel
*
* files used: office, ioffice, uses, maintains
*
set exact on
SET FORMAT TO SCREEN
SET TALK OFF
SET COLOR TO 30,14
ERASE
 12,3 SAY STANDBY PLEASE...
use office index ioffice
store t to domore
* This starts a loop which runs the program until the user wants to quit
do while domore
   erase
   ?
   ?
ACCEPT ENTER THE OFFICE SYMBOL OF THE RECORD TO BE DELETED TO X
STORE ! (x) TO KEY
ERASE
  FIND &KEY
 IF
 = 0
ERASE
   ?
   ?
  ? AN OFFICE WITH THE SYMBOL OF :  ,KEY,                    NOT IN FILE
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DOANSW
* This allows the user to make a mistake
   ERASE
   IF   DOANSW  <> Y  .AND. DOANSW <> y

     STORE F TO DOMORE
  ENDIF
ELSE
*put data up so user can be sure he has the correct OFFICE to delete
   store OFC     TO DOSYM
   store ONAME TO DOROLE
*
 7,1 say OFFICE SYMBOL IS
```

```
 7,18 SAY DOSYM
 9,1  SAY OFFICE NAME IS
 9,  19 SAY DOROLE
?
?
? **********  WARNING!  ************  WARNING!  *********  WARNING!  ********
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion
IF !(PROCEED) = Y
    ERASE
    14,7 SAY ' STANDBY PLEASE...'
   DELETE
   USE USES
  DELETE ALL FOR TRIM(OFC) = TRIM(KEY)
   USE MAINTAINS
   DELETE ALL FOR TRIM(OFC) = TRIM(KEY)

ENDIF
ERASE
  ?
  ?
* This allows the user to continue deleting records
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> Y .AND DOAGI <> y
     ERASE
     STORE F TO DOMORE
  ELSE
    USE OFFICE INDEX IOFFICE
  ENDIF
  ENDIF
  ERASE
ENDDO
REMARK STANDBY PLEASE
* The program is exited
 USE OFFICE
* The pack command actually does the deletion
 PACK
 USE USES
 PACK
 USE MAINTAINS
 PACK
ERASE
RELEASE ALL
RETURN

* Program: name del-category
*
```

```
* purpose: to delete category records from dictionary
*
* programmer: al noel
*
* files used: category, icategory
*
set exact on
SET FORMAT TO SCREEN
SET TALK OFF
SET COLOR TO 30,14
ERASE
store t to domore
* This starts a loop which runs the program until the user wants to quit
do while domore
   use category index icategory
   erase
   ?
   ?
ACCEPT ENTER THE UNIQUE NAME OF THE RECORD TO BE DELETED TO PART1
ACCEPT ENTER THE TYPE OF ENTITY  TO PART2
STORE PART1 - PART2 TC KEY
ERASE
  FIND &KEY
 IF
 = 0
ERASE
   ?
   ?
  ? AN ENTITY WITH THE NAME OF : KEY, AND TYPE:  , PART2,  NOT IN FILE
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DOANSW
* This allows the user to make a mistake
   ERASE
   IF   DOANSW  <> Y  .AND. DOANSW <> y

     STORE F TO DOMORE
  ENDIF
ELSE
*put data up so user can be sure he has the correct OFFICE to delete
   store ENAME   TO DOSYM
   store ETYPE TO DOROLE
*
 7,1 say THE ENTITY'S NAME IS:
 7,23 SAY DOSYM
 9,1 SAY THE ENTITY'S TYPE  IS:
 9, 23 SAY DOROLE
?
?
? ********** WARNING! ********** WARNING! ********* WARNING! ********
```

```
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion
IF !(PROCEED) = Y
   DELETE

ENDIF
ERASE
  ?
  ?
  ?
* This allows the user to continue deleting records
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> Y .AND DOAGI <> y
     ERASE
     STORE F TO DOMORE
  ENDIF
  ENDIF
  ERASE
ENDDO
ERASE
REMARK STANDBY WHILE I PERFORM MAINTENANCE ON THE FILE
* actually remove records marked for deletion above
USE CATEGORY
 PACK
ERASE
RELEASE ALL
RETURN


* Program: name del-field
*
* purpose: to delete field records from dictionary
*
* programmer: al noel
*
* files used: field, ifield, contains
*
set exact on
SET FORMAT TO SCREEN
ERASE
SET COLOR TO 30,14
SET TALK OFF
store t to dmmore
* This starts a loop which runs the program until user wants to quit
do while dmmore
    erase
   use field   index ifield
  ?
```

```
   ?
ACCEPT ENTER THE FIELD'S   UNIQUE NAME PLEASE TO DMNUM
ERASE
* This locates the exact record
  FIND &DMNUM
 IF
 = 0
   ?
   ?
   ?
  ? A FIELD  NAMED:        DMNUM, IS NOT IN THE FILE, SORRY
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DMANSW
* This allows the user to make a mistake
   ERASE
   IF !(DMANSW) <> Y
     STORE F TO DMMORE
  ENDIF
ELSE
   store fld       to dmmodname
   store purpose  to dmmodelnum
 7,1 say THE FIELD'S UNIQUE NAME IS:
 7,30 SAY DMMODNAME
  9,1 SAY THE FIELD'S  PURPOSE IS:
  9,  30 SAY DMMODELNUM
?
?
? ********** WARNING! ************ WARNING! ********* WARNING! ********
?
* This allows the user to insure they wish to proceed.
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion.
iF !(PROCEED) = Y
   DELETE
   USE CONTAINS
   DELETE ALL FOR    TRIM(ENAME) = TRIM(DMNUM) .AND. TRIM(ETYPE)= 'FIELD'
ENDIF
ERASE
  ?
  ?
* This allows the user to continue deleting records.
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> y .AND. DOAGI <> Y
     ERASE
     STORE F TO DMMORE
  ENDIF
  ENDIF
ENDDO
ERASE
```

```
REMARK STANDBY WHILE I PERFORM MAINTENANCE ON ASSOCIATED FILES
* actually remove records marked for deletion above
 USE CONTAINS
 PACK
 USE FIELD
 PACK
ERASE
RELEASE ALL
RETURN

* Program: name del-report
*
* purpose: to delete report records from dictionary
*
* programmer: al noel
*
* files used: report, ireport, uses, outputs
*
SET FORMAT TO SCREEN
set exact on
ERASE
SET COLOR TO 30,14
SET TALK OFF
store t to dmmore
* This starts a loop which runs the program until user wants to quit
do while dmmore
    use report index ireport
   erase
   ?
   ?
accept ENTER THE REPORT'S UNIQUE NAME PLEASE TO DMNUM
ERASE
* This locates the exact record
  FIND &DMNUM
 IF
 = 0
   ?
   ?
   ?
  ? A REPORT NAMED: , DMNUM, IS NOT IN THE FILE, SORRY
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DMANSW
* This allows the user to make a mistake
   ERASE
   IF !(DMANSW) <> Y
     STORE F TO DMMORE
  ENDIF
ELSE
```

```
*put data up so user can be sure he has the correct model to delete
   store rname     to dmmodname
   store purpose  to dmmodelnum
 7,1 say THE REPORT'S UNIQUE  NAME IS:
 7,30 SAY DMMODNAME
 9,1 SAY THE REPORT'S PURPOSE  IS:
 9, 30 SAY DMMODELNUM
?
?
? ********** WARNING! ********** WARNING! ********* WARNING! ********
?
?
* This allows the user to insure they wish to proceed.
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion.
iF !(PROCEED) = Y
   DELETE
   USE USES
   DELETE ALL FOR    TRIM(ENAME) = TRIM(DMNUM) .AND. TRIM(ETYPE)= 'REPORT'
   USE OUTPUTS
   DELETE ALL FOR  TRIM(ENAME)= TRIM(DMNUM) .AND. TRIM(ETYPE) = 'REPORT'

ENDIF
ERASE
  ?
  ?
* This allows the user to continue deleting records.
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> y .AND. DOAGI <> Y
     ERASE
     STORE F TO DMMORE
  ENDIF
  ENDIF
ENDDO
ERASE
REMARK STANDBY WHILE I PERFORM MAINTENANCE ON ASSOCIATED FILES
 USE USES
 PACK
 USE OUTPUTS
 PACK
 USE REPORT
  PACK
 16, 15 say GOOD BYE FROM THE DELETE REPORT PROGRAM
ERASE
RELEASE ALL
RETURN
```

```
* Program: name del-model
*
* purpose; to delete model records from dictionary
*
* programmer: al noel
*
* files used: model, imodel, inputs, outputs, uses, maintains
*
SET FORMAT TO SCREEN
set exact on
ERASE
SET COLOR TO 30,14
SET TALK OFF
*
store t to dmmore
* This starts a loop which runs the program until user wants to quit
do while dmmore
   USE MODEL INDEX IMODEL
   erase
   ?
   ?
accept ENTER MODEL'S UNIQUE NAME PLEASE TO DMNUM
ERASE
* This locates the exact record
  FIND &DMNUM
 IF
 = 0
   ?
   ?
   ?
   ?
  ? A MODEL NAMED: , DMNUM, IS NOT IN THE FILE, SORRY
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DMANSW
* This allows the user to make a mistake
   ERASE
   IF !(DMANSW) <> Y
     STORE F TO DMMORE
  ENDIF
ELSE
*put data up so user can be sure he has the correct model to delete
   store mdl       to dmmodname
   store modname  to dmmodelnum
 7,1 say THE MODEL'S UNIQUE  NAME IS:
 7,30 SAY DMMODNAME
 9,1 SAY THE MODEL'S FULL NAME IS:
 9, 30 SAY DMMODELNUM
?
?
? ********** WARNING! ********** WARNING! ********* WARNING! ********
```

```
?
?
* This allows the user to insure they wish to proceed.
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion.
IF !(PROCEED) = Y
   ERASE
   14,7 SAY  'STANDBY PLEASE...'
   DELETE
   USE USES
   DELETE ALL FOR    TRIM(ENAME) = TRIM(DMNUM) .AND. TRIM(ETYPE)= 'MODEL'
   USE MAINTAINS
   DELETE ALL FOR            TRIM(MDL) = TRIM(DMNUM)
   USE INPUTS
   DELETE ALL FOR TRIM(ENAME1) = TRIM(DMNUM) .AND. TRIM(ETYPE1) ='MODEL'
   USE OUTPUTS
   DELETE ALL FOR TRIM(ENAME1) = TRIM(DMNUM) .AND. TRIM(ETYPE1) = 'MODEL'
   USE CALLS
   DELETE ALL FOR TRIM(ENAME1) = TRIM(DMNUM) .AND. TRIM(ETYPE1) = 'MODEL'
ENDIF
ERASE
  ?
  ?
* This allows the user to continue deleting records.
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> y .AND. DOAGI <> Y
     ERASE
     STORE F TO DMMORE
  ENDIF
  ENDIF
ENDDO
ERASE
REMARK  STANDBY WHILE I PERFORM MAINTENANCE ON ASSOCIATED FILES...
* actually remove records marked for deletion above
 USE USES
 PACK
 USE MAINTAINS
 PACK
 USE MODEL
  PACK
 USE OUTPUTS
 PACK
 USE INPUTS
 PACK
 USE CALLS
 PACK
CLEAR
 16, 15 say GOOD BYE FROM THE DELETE MODEL PROGRAM
```

```
ERASE
RELEASE ALL
RETURN

* Program: name del-program
*
* purpose: to delete records for programs from dictionary
*
* programmer: al noel
*
* files used: program, iprogram, calls
*
SET FORMAT TO SCREEN
set exact on
ERASE
SET COLOR TO 30,14
SET TALK OFF
*
store t to dmmore
* This starts a loop which runs the program until user wants to quit
do while dmmore
   ERASE
    use program index iprogram
   ?
   ?
  ?     ENTER THE PROGRAM'S UNIQUE NAME PLEASE
ACCEPT 'PLEASE STRING TOGETHER PROGRAM NAME AND VERSION,I.E. UTRACS1 ' TO DMNUM
ERASE
* This locates the exact record
  FIND &DMNUM
 IF
 = 0
   ?
   ?
   ?
  ? A PROGRAM NAMED: , DMNUM, IS NOT IN THE FILE, SORRY
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DMANSW
* This allows the user to make a mistake
   ERASE
   IF !(DMANSW) <> Y
     STORE F TO DMMORE
  ENDIF
ELSE
ERASE
*put data up so user can be sure he has the correct model to delete
   store pname      to dmmodname
   store       version to dmversion
```

```
   store purpose  to dmmodelnum
 7,1 say THE PROGRAM'S UNIQUE  NAME IS:
 7,30 SAY DMMODNAME
 9,1 say THE VERSION NUMBER IS:
 9,24 SAY DMVERSION
 11,1 SAY THE PROGRAM'S PURPOSE  IS:
 11, 30 SAY DMMODELNUM
?
?
? ********** WARNING! ********** WARNING! ********* WARNING! ********
?
* This allows the user to insure they wish to proceed.
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion.
iF !(PROCEED) = Y
   DELETE
   USE CALLS
   DELETE ALL FOR    TRIM(ENAME) = TRIM(DMNUM) .AND. TRIM(ETYPE)= 'PROGRAM'
ENDIF
ERASE
  ?
  ?
* This allows the user to continue deleting records.
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> y .AND. DOAGI <> Y
     ERASE
     STORE F TO DMMORE
  ENDIF
  ENDIF
ENDDO
ERASE
REMARK STANDBY WHILE I PERFORM MAINTENANCE ON ASSOCIATED FILES
*actually remove records marked for deletion above
 USE CALLS
 PACK
 USE PROGRAM
  PACK
ERASE
RELEASE ALL
RETURN

* Program: name del-alias
*
* purpose: to delete alias records from dictionary
*
* programmer: al noel
*
```

```
* files used: alias, ialias
*
set exact on
SET FORMAT TO SCREEN
SET TALK OFF
SET COLOR TO 30,14
ERASE
store t to domore
* This starts a loop which runs the program until the user wants to quit
do while domore
   use alias index ialias
   erase
   ?
   ?
ACCEPT ENTER THE UNIQUE NAME OF THE ENTITY TO BE DELETED TO PART1
ACCEPT ENTER THE ENTITY'S ALIAS  TO PART2
STORE PART1 - PART2 TO KEY
ERASE
  FIND &KEY
 IF
 = 0
ERASE
   ?
   ?
  ? AN ENTITY WITH THE NAME OF :,KEY, AND ALIAS OF:  , PART2,  NOT IN FILE
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DOANSW
* This allows the user to make a mistake
   ERASE
   IF   DOANSW  <> Y  .AND. DOANSW <> y

     STORE F TO DOMORE
  ENDIF
ELSE
*put data up so user can be sure he has the correct OFFICE to delete
   store ENAME   TO DOSYM
   store ANAME TO DOROLE
*
 7,1 say THE ENTITY'S NAME IS:
 7,23 SAY DOSYM
 9,1 SAY THE ENTITY'S ALIAS IS:
 9, 23 SAY DOROLE
?
?
? **********  WARNING!  ************  WARNING!  *********  WARNING!  ********
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion
IF !(PROCEED) = Y
   DELETE
```

```
ENDIF
ERASE
  ?
  ?
  ?
* This allows the user to continue deleting records
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> Y .AND DOAGI <> y
     ERASE
     STORE F TO DOMORE
  ENDIF
  ENDIF
  ERASE
ENDDO
ERASE
REMARK STANDBY WHILE I PERFORM MAINTENANCE ON THE FILE
* actually remove records marked for deletion above
USE ALIAS
 PACK
ERASE
RELEASE ALL
RETURN
```



```
* Program: name del-element
*
* purpose: to delete an element record from the dictionary
*
* programmer; al noel
*
* files used: element, ielement, contains
*
SET FORMAT TO SCREEN
ERASE
SET COLOR TO 30,14
SET TALK OFF
set exact on
store t to dmmore
* This starts a loop which runs the program until user wants to quit
do while dmmore
    erase
```

```
    use element index ielement
    ?
    ?
ACCEPT ENTER THE ELEMENT'S UNIQUE NAME PLEASE TO DMNUM
ERASE
* This locates the exact record
  FIND &DMNUM
 IF
 = 0
    ?
    ?
    ?
  ? A ELEMENT  NAMED:     ' DMNUM, IS NOT IN THE FILE, SORRY
  ACCEPT ENTER A Y IF YOU WISH TO TRY AGAIN TO DMANSW
* This allows the user to make a mistake
    ERASE
    IF !(DMANSW) <> Y
      STORE F TO DMMORE
  ENDIF
ELSE
    store elname    to dmmodname
    store purpose  to dmmodelnum
 7,1 say THE ELEMENT'S  UNIQUE NAME IS:
 7,30 SAY DMMODNAME
 9,1 SAY THE ELEMENT'S  PURPOSE IS:
 9, 30 SAY DMMODELNUM
?
?
? ********** WARNING! ********** WARNING! ********* WARNING! ********
?
* This allows the user to insure they wish to proceed.
ACCEPT IF YOU ARE SURE THIS IS THE RECORD TO BE DELETED ENTER A Y TO PROCEED
* The delete command only marks the record for deletion.
iF !(PROCEED) = Y
    DELETE
    USE CONTAINS
    DELETE ALL FOR     TRIM(ENAME) = TRIM(DMNUM) .AND. TRIM(ETYPE)= 'ELEMENT'
ENDIF
ERASE
   ?
   ?
* This allows the user to continue deleting records.
  ACCEPT DO YOU WISH TO CONTINUE DELETING RECORDS ?  IF SO ENTER A Y TO DOAGI
  IF DOAGI <> y .AND. DOAGI <> Y
     ERASE
     STORE F TO DMMORE
  ENDIF
  ENDIF
```

```
ENDDO
ERASE
REMARK STANDBY WHILE I PERFORM MAINTENANCE ON ASSOCIATED FILES
 USE CONTAINS
 PACK
 USE ELEMENT
 PACK
ERASE
RELEASE ALL
RETURN

* PROGRAM: QERY-MENU
*
* purpose: to permit user to select query program he desires
*
* programmer: al noel
*
* files used: model, office, report, file, element, field, uses, contains
*             maintains, inputs, outputs, calls, program
*
* programs called: fortrev, baktrev, foral, bakal, forcat, bakcat
SET FORMAT TO SCREEN
set color to 30,14
set talk off
ERASE
* set up loop
DO WHILE T
    1,0
     TEXT
This is the QUERY  menu. It permits you  to have the dictionary process
ad-hoc queries.      Queries are either of the 'forward' type where an entity
is the subject and you specify the verb and object or of the 'backward' type
where the entity you give is the object of an action and subject.

                    QUERY MENU

  1) Forward type (i.e. P3M calls what programs ?)  (FORTREV)
  2) Backward type (i.e. P3M is used by what offices ?) (BAKTREV)
  3) Forward type for aliases ( indicate type and system provides all aliases)
                                  (FORAL)
  4) Backward type for aliases  (give entity name and system provides all
          (BAKAL)                 aliases for that particular entity)

  5) Forward type for categories (indicate type and system gives categories)
                                  (FORCAT)
  6) Backward type for categories (give entity name and system gives all
                  (BAKCAT)          categories that entity is in)
```

```
        0 to quit

Enter the selection here
ENDTEXT
* wait for user choice of programs
WAIT TO RMSELECT
 20,0    SAY
 21,0    SAY
* set up case statement for calling of program per user choice
 DO CASE
   CASE RMSELECT = 0
      USE
      clear
      ERASE
      RELEASE ALL
      RETURN
   CASE RMSELECT = 1
        DO FORTREV
   CASE RMSELECT = 2
        DO BAKTREV
   CASE RMSELECT = 3
        DO foral
   CASE RMSELECT = 4
        DO bakal
   CASE RMSELECT = '5'
        DO forcat
   CASE RMSELECT = '6'
        DO bakcat

   OTHERWISE
      * error message for choice of number s not in range of case statement
      ERASE
      20,0 SAY Please enter values between 0 and 6 only
      21,0 SAY Please try again
  ENDCASE
ENDDO
RETURN



* program:  fortreve.prg
*
* purpose: for querying in a 'forward' manner, that is, subject then verb,
*           then object, i.e. model calls programs
*
* programmer: al noel
*
```

```
* files used: model, office, program, file, element, field, uses, maintains,
*              calls, inputs, outputs, contains
*
set exact on
SET FORMAT TO SCREEN
SET COLOR TO 30,14
set talk off
* set up loop
store t to floop
do while floop
     erase
     * init variables for screen
     store ' ' to qit
     store '                ' to qs:office
     store ' ' to qv:uses
     store ' ' to qo:reports
     store ' ' to qv:maintan
     store ' ' to qo:model
     store '                ' to qs:model
     store ' ' to qv:calls
     store ' ' to qo:program
     store ' ' to qv:inputs
     store ' ' to qo:file
     store ' ' to qv:outputs
     store '                ' to qs:file
     store ' ' to qv:contain
     store ' ' to qo:element
     store '                ' to qs:element
     store ' ' to qo:fields
* put screen up for user to indicat subject and mark verb and object with x's
 2,1 say '     SUBJECTS                    VERBS                       OBJECTS'
 3,1 SAY '     --------                    -----                       --------'
 5,3 SAY 'Office' get qs:office
 5,30 say 'Uses' get qv:uses
 5,52 say 'Reports' get qo:reports
 6, 25 say 'Maintains' get qv:maintan
 6,53 say 'Models' get qo:model
  9,4 say 'Model' get qs:model
  9,29 say 'Calls' get qv:calls
  9,51 say 'Programs' get qo:program
 10,28 say 'Inputs' get qv:inputs
 11,27 say 'Outputs' get qv:outputs
 10,  54 SAY 'Files' get qo:file
 13,5 say  'File' get qs:file
 14,26 say 'Contains' get qv:contain
 13,  51 say 'Elements'get qo:element
 15,2 say 'Element' get qs:element
 15,  53 say 'Fields' get qo:fields
```

```
 17, 4 say 'To quit put an X in this field'                                get qit
remark
remark Put the unique name of the entity you are querying about in the field
remark next to the entity's type.  Then place an X in one appropriate verb
remark field for that entity type and an X in one appropriate object field.
remark          I.E.  Office:DAPC-PLF    :   Uses:X:      Models:X:
remark To process query move cursor through remaining fields using RETURN  key
read
store 'Strike any key to continue...' to msg
* if user wants to quit, then no blank in quit field
if qit <> ' '
   erase
   clear
   release all
   return
else
   erase
* if subject not blank, then lock for verb and use file associated with verb
* also load query message with appropriate subject and verb wordings
* subjects are marked as gs variables, verbs as gv and objects as go.
* display statements put up on screen for condtions met
* loop commands jump around remaining code of loop to save checking
* if user mistakenly marks more than one subject, the first marked gets
* executed only then program jumps around remainder with loop statement
* program waits for use to hit any key before pressentin blank screen for
* another query
   ?
   if $(gs:office,1,2) <>  '  '
     store 'The office '+gs:office to query
     if gv:uses <> ' '
        store query+'uses ' to query
        use uses
     else
        store query+ 'maintains ' to query
        use maintains
     endif
     if go:reports <> ' '
        store query+'the following reports ' to query
        ? query
        ?
        display ename for trim(gs:office) = trim(ofc)  .and. trim(etype)  ;
        = 'REPORT' OFF
        ?
        ? msg
        wait to continue
        loop
     endif
     if go:model  <> ' ' .and. gv:uses <> ' '
```

```
      store query+     ' the following models' to query
      ?
      ? query
      ?
     display ename  for trim(qs:office) = trim(ofc) .and. trim(etype) ='MODEL';
        off
        ?
        ? msg
        wait to continue
        loop
     endif
     if qo:model  <> ' ' .and. qv:maintan <> ' '
        store query+ 'the following models ' to query
       ? query
       ?
        display mdl for trim(qs:office) = trim(ofc) off
        ?
        ? msg
        wait to continue
        loop
     endif
  endif
  if $(qs:model,1,2) <> '  '
     store 'The model '+qs:model to query
     if qv:calls <> ' '
        store query+ 'calls the following programs ' to query
        use calls
         ? query
         ?
        display ename for trim(qs:model) = trim(ename1) .and. trim(etype1) = ;
        'MODEL' .and. trim(etype) = 'PROGRAM' off
        ?
        ? msg
        wait to continue
        loop
     endif
   if qv:inputs <> ' '
      store query+ ' inputs the following files ' to query
     use inputs
     ? query
     ?
     display ename for trim(qs:model) = trim(ename1) .and. trim(etype1) = ;
     'MODEL' .and. trim(etype) = 'FILE'  OFF
      ?
      ? msg
     wait to continue
     loop
   endif
```

```
    if gv:outputs <> ' '
       store query+' outputs to the following files ' to query
       use outputs
       ?   query
       ?
       display ename for trim(qs:model) = trim(ename1) .and. trim(etype1) = ;
       'MODEL' .and. trim(etype) = 'FILE' OFF
        ?
        ? msg
       wait to continue
       loop
    endif
  endif
  if $(qs:file,1,2) <> '  '
    store 'The file '+qs:file+'  contains the following elements ' to query
    use contains
    ? query
    ?
    display ename for trim(qs:file) = trim(ename1) .and. trim( etype1) = ;
    'FILE' .and. trim(etype) = 'ELEMENT'  off
     ?
     ? msg
     wait to continue
     loop
  endif
  if $(qs:element,1,2) <> '  '
     store 'The element '+qs:element+ ' contains the following fields ' to query
     use contains
     ? query
     ?
     display ename for trim(qs:element) = trim(ename1) .and. trim(etype1) = ;
     'ELEMENT' .and trim(etype) = 'FIELD' OFF
     ?
     ? msg
     wait to continue
     loop
  endif
 endif
enddo while floop

* program baktrev.prg
*
* purpose: to make queries in 'backwards' fashion, that is, with user
*          providing object and the system finding what entity uses, contains,
*          whatefer, for the entity given
*
* programmer: al noel
*
```

```
* files used: model, office, report, program, file, element, field, uses,
*              maintains, contains, inputs, outputs, calls
*
set exact on
SET FORMAT TO SCREEN
erase
set color to 30,14
set talk off
* set up loop for work
store t to floop

do while floop
   erase
* init variables for screen
   store ' ' to qit
   store '          ' to qo:model
   store '           ' to qo:report
   store ' ' to qv:uses
   store ' ' to qv:maintan
   store ' ' to qs:office
   store '                ' to qo:program
   store '                 ' to qo:file
   store ' ' to qv:calls
   store ' ' to qv:inputs
   store ' ' to qv:outputs
   store ' ' to qs:model
   store '             ' to qo:element
   store '              ' to qo:field
   store ' ' to qv:contain
   store ' ' to qs:file
   store ' 'to qs:element
   store ' ' to qv:contain
* put up screen for user to give object and mark verb and subject
   REMARK  OBJECTS                          VERBS                    SUBJECTS
   REMARK  -------                          -----                    --------
   REMARK
   5,3 say 'Model' get qo:model
   7,2 say 'Report' get qo:report
   5,31 say 'Is used by' get qv:uses
   7,25 say 'Is maintained by' get qv:maintan
   5,51 say 'Office' get qs:office
   9,1 say 'Program' get qo:program
   10,4 say 'File' get qo:file
   9,29 say 'Is called by' get qv:calls
   10,27 say 'Is inputted by' get qv:inputs
   11,26 say 'Is outputted by' get qv:outputs
   10,52 say 'Model' get qs:model
   12,1 say 'Element' get qo:element
```

```
   14,3 say 'Field' get qo:field
   13,26 say 'Is contained in' get  qv:contain
   12,53 say 'File' get qs:file
   14,50 say 'Element' get qs:element
   18,4 say 'To quit put an X in this field' get qit
remark
remark  Enter the name of the entity besides its type and then mark 1 verb
remark  field and 1 subject field. To process query move cursor down through
remark  remaining fields using RETURN key.
read
* if qit not blank , quit program and exit
if qit <>' '
   erase
   release all
   clear
   return
else
   * load message to continue to variable
   store 'Strike any key to continue ...' to msg
   erase
* check for nonblank object variable, then, if not blank, use file indicated
* by verb variable marked with x and subject in same fashion
* load message about which query is being made according to selection and
* run display command loaded with values given .
*
   if $(qo:model,1,2) <> ' '
     store 'The model '+qo:model to query
     if qv:uses <> ' '
         store query+' is used by the following offices ' to query
         use uses
         ? query
         ?
         display ofc for trim(ename) = trim(qo:model) .and. trim(etype) = ;
          'MODEL' off
         ?
         ? msg
         wait to continue
         loop
     el
         store query+' is maintained by the following offices ' to query
         use maintains
         ? query
         ?
         display ofc,modelpoc  for trim(mdl) = trim(qo:model)  off
         ?
         ? msg
         wait to continue
         loop
```

```
      endif
    endif
    if $(go:report,1,2) <> ' ' .and.    gv:uses    <> ' '
       use uses
       store 'The report '+go:report+ ' is used by the offices ' to query
       ? query
       ?
       display ofc for trim(go:report) = trim(ename) .and. trim(etype) = ;
       'REPORT' off
       ?
       ? msg
       wait to continue
      loop
    endif
    if $(go:report,1,2) <> ' ' .and. gv:outputs <> ' '
       use outputs
       store 'The report '+go:report+' is output by the models ' to query
       ? query
       ?
       display ename1 for trim(go:report) = trim(ename) .and. trim(etype1) = ;
       'MODEL' .and. trim(etype) = 'REPORT' off
       ?
       ? msg
       wait to continue
       loop
endif
if $(go:program,1,2) <> ' '
  if gv:calls <> ' '  .and. gs:model <> ' '
     use calls
     STORE 'The program '+go:program+ ' is called by the models ' to query
      ? query
      ?
     display ename1 for trim(go:program) = trim(ename) .and. trim(etype) = ;
     'PROGRAM' .and. trim(etype1) = 'MODEL' off
     ?
     ? msg
     wait to continue
     loop
  endif

endif

if $(go:file,1,2) <> ' '
    store 'The file '+go:file to query
    if gv:inputs   <> ' '      .and. gs:model <> ' '
      use inputs
       store query+' is input by the following models ' to query
       ? query
```

```
        ?
        display ename1 for trim(ename) = trim(go:file) .and. trim(etype) = ;
        'FILE' .and. trim(etype1) = 'MODEL' off
        ?
        ? msg
        wait to continue
       loop
      endif
      if  gv:outputs  <>  ' '  .and. gs:model <> ' '
         use outputs
         store query + ' is outputted to by the following models' to query
         ? query
         ?
         display ename1 for trim(ename) =    trim(go:file) .and. trim(etype) ;
         = 'FILE' .and. trim(etype1) = 'MODEL'  off
         ?
         ? msg
         wait to continue
         loop
      endif
   endif
   if $(go:element,1,2) <> ' '
      if gv:contain  <> ' '   .and. gs:file <> ' '
         use contains
         store 'The element '+go:element+ ' is contained by the files'to query
         ? query
         ?
         display ename1 for trim(ename) = trim(go:element) .and. trim(etype) ;
         = 'ELEMENT' .and. trim(etype1) = 'FILE' off
         ?
         ? msg
         wait to continue
         loop
   endif

   endif
   if $(go:field,1,2) <> ' '
      if gv:contain  <> ' '    .and. gs:element <> ' '
      use contains
      store 'The field '+go:field+' is contained by the elements ' to query
      ? query
      ?
      display ename1 for trim(ename) = trim(go:field) .and. trim(etype) = ;
      'FIELD' .and. trim(etype1) = 'ELEMENT' off
      ?
      ? msg
      wait to continue
      loop
```

```
      endif

    endif
  endif
enddo while floop
* program foral.prg
*
* purpose: forward queries on aliases. user marks the type of entity
*          and the program then tells him all names and aliases in alias file
*          for that type of entity.
*
* programmer: al noel
*
* files used: alias
*
*
set exact on
SET FORMAT TO SCREEN
set color to 30,14
erase
use alias
set talk off
* set up loop for work
store t to fraloop
do while fraloop
   * init screen variables
   store ' ' to qmodel
   store ' ' to qprogram
   store ' ' to qfile
   store ' ' to qoffice
   store ' ' to qreport
   store ' ' to qfield
   store ' ' to qelement
   store ' ' to  it
   * put screen up for use to mark entity he wants aliases for
   7,11 say 'Model' get qmodel
   9,9 say 'Program' get qprogram
   11,10 say 'Report' get qreport
   7,38 say 'File' get qfile
   9,35 say 'Element' get qelement
   11,37 say 'Field' get qfield
   13,15 say 'To quit enter an X here' get qit
 17,1 say 'Enter an X in the field besides the type of entity for which'
 18,1 say  'you want all names and aliases. Mark only 1 field.'
   read
* if qit not blank , quit program
   if qit <> ' '
      erase
```

```
        clear
        release all
        return

    else
  * if q variable not blank then load type variable with apprpriate type
  * and load query variable with appropriate words for query message to use
  *
        if qreport <> ' '
           store 'The following reports have the associated aliases ' to query
           store 'REPORT' TO TYPE
        endif
        IF QMODEL <> ' '
           store 'The following models have the associated aliases ' to query
           STORE 'MODEL' TO TYPE
        ENDIF
        IF QPROGRAM <> ' '
          store 'The following programs have the associated aliases ' to query
           STORE 'PROGRAM' TO TYPE
        ENDIF
        IF QOFFICE <> ' '
           store 'The following offices have the associated aliases ' to query
           STORE 'OFFICE' TO TYPE
        ENDIF
        IF QFILE <> ' '
           store 'The following files have the associated aliases ' to query
           STORE 'FILE' TO TYPE
        ENDIF
        IF QELEMENT <> ' '
           store 'The following elements have the associated aliases ' to query
           STORE 'ELEMENT' TO TYPE
        ENDIF
        IF QFIELD <> ' '
           store 'The following fields have the associated aliases ' to query
           STORE 'FIELD' TO TYPE
        ENDIF
        ERASE
        * display query message built above and records that meet conditions
        * loaded
        ? query
        ?
        DISPLAY ENAME, ANAME FOR TRIM(ETYPE) =          TYPE  OFF
        ?
        ? 'Strike any key to continue...'
        wait to continue
        erase
     endif
  enldo while fraloop
```

```
* program bakal.prg
*
* purpose: backward queries on aliases. user gives the entity name and the
*          program then tells him all aliases in alias file for the entity
*
* programmer: al noel
*
* files used: alias
*
set exact on
SET FORMAT TO SCREEN
set color to 30,14
erase
use alias
set talk off
* set up loop
store t to fraloop
do while fraloop
   * init screen variables
   store '          ' to qmodel
   store '                ' to qprogram
   store '                  ' to qfile
   store '           ' to qoffice
   store '            ' to qreport
   store '                ' to qfield
   store '              ' to qelement
   store ' ' to qit
   * put screen up for user to give entity he wants aliases for
   7,11 say 'Model' get qmodel
   9,9 say 'Program' get qprogram
   11,10 say 'Report' get qreport
   7,38 say 'File' get qfile
   9,35 say 'Element' get qelement
   11,37 say 'Field' get qfield
   13,15 say 'To quit enter an X here' get qit
  17,1 say 'Enter the name of the entity in the field beside  its type  '
  18,1 say  'Provide only 1 name.'
   read
* if qit nonblank, quit program
   if qit <> ' '
      erase
      clear
      release all
      return

   else
* if q variable nonblank, load appropriate words to type variable and and
* appropriate words to query variable for display command later
```

```
      if $(qreport,3,1) <> ' '
         store 'The report '+qreport+ ' has the following aliases ' to query
         store 'REPORT' TO TYPE
         store qreport to name
      endif
      IF $(QMODEL,3,1) <> ' '
         store 'The model '+QMODEL+ ' has the following aliases ' to query
         STORE 'MODEL' TO TYPE
         store qmodel to name
      ENDIF
      IF $(QPROGRAM,3,1) <> ' '
         store 'The program '+QPROGRAM+ ' has the following aliases ' to query
         STORE 'PROGRAM' TO TYPE
         store qprogram to name
      ENDIF
      IF $(QOFFICE,3,1) <> ' '
         store 'The office '+QOFFICE+ ' has the following aliases ' to query
         STORE 'OFFICE' TO TYPE
         store qoffice to name
      ENDIF
      IF $(QFILE,3,1) <> ' '
         store 'The file '+QFILE+ ' has the following aliases ' to query
         STORE 'FILE' TO TYPE
         store qfile tc name
      ENDIF
      IF $(QELEMENT,3,1) <> ' '
         store 'The element '+QELEMENT+ ' has the following aliases ' to query
         STORE 'ELEMENT' TO TYPE
         store qelement to name
      ENDIF
      IF $(QFIELD,3,1) <> ' '
         store 'The field '+QFIELD+ ' has the following aliases ' to query
         STORE 'FIELD' TO TYPE
         store qfield to name
      ENDIF
      ERASE
* display query command built above and run actuall display command
*  then wait for user to hit any key to get fresh screen for another run
      ? query
      ?
      DISPLAY         ANAME FOR TRIM(ETYPE) = TYPE .AND. TRIM(ENAME) = ;
       TRIM(NAME) OFF
      ?
      ? 'Strike any key to continue...'
      wait to continue
      erase
   endif
```

```
enddo while fraloop
* program foral.prg
*
* purpose: forward queries on categories. user marks the type of entity
*          and the program then tells him all names and associated categories
*           that type of entity
*
* programmer: al noel
*
* files used: category
*
set exact on
SET FORMAT TO SCREEN
set color to 30,14
erase
use category
set talk off
* set up loop
store t to fraloop
do while fraloop
   * init screen variables
   store ' ' to qmodel
   store ' ' to qprogram
   store ' ' to qfile
   store ' ' to qoffice
   store ' ' to qreport
   store ' ' to qfield
   store ' ' to qelement
   store ' ' to qit
   * put up screen
   7,11 say 'Model' get qmodel
   9,9 say 'Program' get qprogram
   11,10 say 'Report' get qreport
   7,38 say 'File' get qfile
   9,35 say 'Element' get qelement
   11,37 say 'Field' get qfield
   13,15 say 'To quit enter an X here' get qit

 17,1 say 'Enter an X in the field besides the type of entity for which'
 18,1 say  'you want all names and associated category. Mark only 1 field'
   read
* if qit nonblank, quit program and return
   if qit <> ' '
      erase
      clear
      release all
      return
```

```
   else
* q variable marked dets. what gets loaded in type variable for use in
* display command and also what words go into query variable to tell user
*  what he queried for along with output

      if qreport <> ' '
         STORE 'The following reports are in the associated category ' to query
         store 'REPORT' TO TYPE
      endif
      IF QMODEL <> ' '
         store 'The following models are in the associated category ' to query
         STORE 'MODEL' TO TYPE
      ENDIF
      IF QPROGRAM <> ' '
       store 'The following programs are in the associated category ' to query
         STORE 'PROGRAM' TO TYPE
      ENDIF
      IF QOFFICE <> ' '
         store 'The following offices are in the associated category ' to query
         STORE 'OFFICE' TO TYPE
      ENDIF
      IF QFILE <> ' '
         store 'The following files are in the associated category ' to query
         STORE 'FILE' TO TYPE
      ENDIF
      IF QELEMENT <> ' '
         store 'The following elements are in the associated category' to query
         STORE 'ELEMENT' TO TYPE
      ENDIF
      IF QFIELD <> ' '
          store 'The following fields are in the associated category ' to query
         STORE 'FIELD' TO TYPE
      ENDIF
      ERASE
* display query variable words and actual results of retrieval, wait for use
* to strike any key to give him fresh screen for new query to run
    ? query
    ?
     DISPLAY ENAME, CAT   FOR TRIM(ETYPE) =         TYPE  OFF
     ?
     ? 'Strike any key to continue...'
     wait to continue
     erase
   endif
enddo while fraloop

* program bakcat.prg
*
```

```
* purpose: backward queries on categories, user gives the entity name and the
*          program then tells him all categories in category fiel for the
*          entity
*
* programmer: al noel
*
* files used: category
*
set exact on
SET FORMAT TO SCREEN
set color to 30,14
erase
use category
set talk off
* set up loop
store t to fraloop
do while fraloop
   * init screen variables
   store '          ' to qmodel
   store '                ' to qprogram
   store '                   ' to qfile
   store '          ' to qoffice
   store '           ' to qreport
   store '                ' to qfield
   store '             ' to qelement
   store ' ' to qit
   * put screen up for user to give entity name to retrieve on
   7,11 say 'Model' get qmodel
   9,9 say 'Program' get qprogram
   11,10 say 'Report' get qreport
   7,38 say 'File' get qfile
   9,35 say 'Element' get qelement
   11,37 say 'Field' get qfield
   13,15 say 'To quit enter an X here' get qit
 17,1 say 'Enter the name of the entity in the field beside  its type  '
 18,1 say  'Provide only 1 name.'
   read
* if qit nonblank, quit program and return
   if qit <> ' '
      erase
      clear
      release all
      return

   else
* depending on q variable marked appropriate words are loaded into query
* variable and to type variable to control display command later
```

```
      if $(qreport,3,1) <> ' '
         STORE 'The report '+qreport+' is in the associated category' to query
         store 'REPORT' TO TYPE
         store qreport to name
      endif
      IF $(QMODEL,3,1) <> ' '
         store 'The model '+QMODEL+' is in the associated category ' to query
         STORE 'MODEL' TO TYPE
         store qmodel to name
      ENDIF
      IF $(QPROGRAM,3,1) <> ' '
        store 'The program '+QPRCGRAM+' is in the associated category ' to query
         STORE 'PROGRAM' TO TYPE
         store qprogram to name
      ENDIF
      IF $(QOFFICE,3,1) <> ' '
         store 'The office '+QOFFICE+' is in the associated category ' to query
         STORE 'OFFICE' TO TYPE
         store qoffice to name
      ENDIF
      IF $(QFILE,3,1) <> ' '
         store 'The file '+QFILE+' is in the associated category ' to query
         STORE 'FILE' TO TYPE
         store qfile tc name
      ENDIF
      IF $(QELEMENT,3,1) <> ' '
         store 'The element '+QELEMENT+' is in the associated category' to query
         STORE 'ELEMENT' TO TYPE
         store qelement to name
      ENDIF
      IF $(QFIELD,3,1) <> ' '
         store 'The field '+QFIELD+' is in the associated category ' to query
         STORE 'FIELD' TO TYPE
         store qfield to name
      ENDIF
      ERASE
* display query words built and run retrieval with display using type
*  determined by what was loaded above from what was marked on screen
      ? query
      ;
      DISPLAY        CAT    FOR TRIM(ETYPE) = TYPE .AND. TRIM(ENAME) = ;
       TRIM(NAME) OFF
      ?
      ? 'Strike any key to continue...'
      wait to continue
      erase
   endif
enddo while fraloop
```

```
* PPOGRAM: REPT-MENU
*
* purpose: to permit user to select program which will provide printed
*          summary report
*
* programmer: al noel
*
* files used: model, office, report, file, program, element, uses, maintains
*             contains, calls, inputs, outputs,
*
SET FORMAT TO SCREEN
set color to 30,14
set talk off
ERASE
*set up loop
DO WHILE T
    1,0
      TEXT
This is the REPORT menu. It permits you  to have the dictionary print
summary type reports.

                  REPORT MENU

   1) for a specific Model all users, maintainers, input& output files,
      and programs called                (SUMOD)
   2) for a specific Report all users, models outputting
            (SUMREP)
   3) for a specific Office all models used, all models maintained, and
      reports used.     (SUMOFF)
   4) for a specific Fileall models it provides input to, recevies output from,
      and elements it contains  (SUMFIL)


        0 to quit

Enter the selection here
ENDTEXT
WAIT TO RMSELECT
 20,0    SAY
 21,0    SAY
* set up case statement for calling of program per user choice
 DO CASE
   CASE RMSELECT = 0
       USE
       clear
       ERASE
       RELEASE ALL
```

```
      RETURN
   CASE RMSELECT = 1
        DO SUMOD
   CASE RMSELECT = 2
        DO SUMREP
   CASE RMSELECT = 3
        DO SUMOFF
   CASE RMSELECT = 4
        DO SUMFIL
   * error message for wrong choice of numbers
   OTHERWISE
     ERASE
     20,0 SAY Please enter values between 0 and 4 only
     21,0 SAY Please try again
  ENDCASE
ENDDO
RETURN



* PROGRAM SUREP.PRG
*
* purpose: to produce printed report on report and all users, and models
*          output that report
*
* programmer: al noel
*
* files used: report, uses, outputs
SET TALK OFF
set color to 30,14
set format to screen
erase
store '          ' to space
*  set up loop
store t to more
do while more
      * prompt user for name of report
      ? Please enter the unique name of the Report
      accept Hit the space bar and RETURN to quit to rmod
      erase
      * if rmod blank, quit progrma
      if rmod =  ' ' .or. rmod =
         erase
         clear
         release all
         return
    else
```

```
        * turn printer on
        set print on
        ? The Report , rmod
        ?
        ? 'Is used by the following offices:'
        * retrieve for users of report given by user of this program
        ?
        use uses
        display ofc for trim(ename)    =  trim(rmod) .and. trim(etype) = 'REPORT' ;
        off
        ?
        ? 'Is produced by the follcwing Models'
        ?
        * retrieve for models that output this report
        use outputs
        display ename1 for trim(ename ) = trim(rmod) .and. trim(etype1) = ;
        'MODEL' .and. trim(etype) = 'REPORT' OFF
        * prompt user to stike any key to make another run of program
        ?
        ? 'Strike any key to continue'
        WAIT TO GOAHEAD
        erase
        set print off
```



```
        endif

enddo
* PROGRAM SUMFIL.PRG
*
* purpose: to produce printed report on a file and all models it is input by,
*          output to, and elements contained
*
* programmer: al noel
*
* files used: file, model, outputs, inputs, contains
*
SET TALK OFF
set color to 30,14
set format to screen
erase
store '          ' to space
store t to more
```

```
*set up loop
do while more
      ? Please enter the unique name  of the File
      accept Hit the space bar and RETURN to quit to rmod
      erase
      * if rmod blank, quit program
      if rmod =  ' ' .or. rmod =
         erase
         clear
         release all
         return
      else
      * turn printer on
      set print on
      ? The File    , rmod
      ?
      ? 'Provides input to the following Models:'
      ?
      * print out that which is for file given by user
      use inputs
      display ename1 for trim(rmod) = trim(ename) .and. trim(etype) = 'FILE' ;
      .and. trim(etype1) = 'MODEL' off
      ?
      ? 'Accepts output from the following Models:'
      ?
      use outputs
      display ename1 for trim(rmod)= trim(ename).and. trim(etype) = 'FILE'  ;
      .and. trim(etype1) = 'MODEI' OFF
      ?
      ? 'Contains the following Elements'
      ?
      use contains
      display ename for trim(ename1) = trim(rmod) .and. trim(etype) = ;
      'ELEMENT' .AND. trim(etype1) = 'FILE'   OFF
      ?
      ?
      * wait for user to strike any key to give fresh screen to run another
      * report
      ?
      ? 'Strike any key to continue'
      WAIT TO GOAHEAD
      erase
      * turn printer off , turn it back on up in loop
      set print off
      SET TALK OFF
      endif

enddo
```

```
* PROGRAM SUMOD.PRG
*
* purpose: to produce printed report on model and all users, maintainers,
*          input, output files, and programs called
*
* programmer: al noel
*
*  files used: model, uses, maintains, inputs, outputs, calls
*
SET TALK OFF
set color to 30,14
set format to screen
erase
store '          ' to space
* set up loop
store t to more
do while more
      ? Please enter the unique name of the Model
      * prompt for model name
      accept Hit the space bar and RETURN to quit to rmod
      erase
      * if rmod blank, quit program
      if rmod =  ' ' .or. rmod =
         erase
         clear
         release all
         return
      else
      * turn printer on
      set print on
      ? The Model , rmod
      ?
      ? 'Is used by the following offices:'
      ?
      * retirev users of mode
      use uses
      display ofc for trim(ename)    =  trim(rmod) .and. trim(etype) = 'MODEL' ;
      off
      ?
      ? 'Is maintained by the following offices with the point of contact:'
      ?
      * retrieve maintainers of model
      use maintains
      display ofc,modelpoc for trim(mdl) = trim(rmod)    off
      ?
      ?  Inputs the following files:
      ?
      * retrieve files input by model
```

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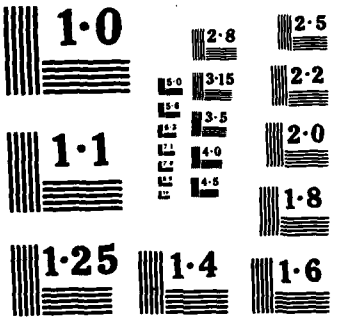

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MICROCOPY RESOLUTION TEST CHART

```
        use inputs
        display ename for trim(ename1) = trim(rmod) .and. trim(etype1) = ;
        'MODEL'  .and. trim(etype) = 'FILE' off
        ?
        ? 'Outputs to the following files:'
        ?
        * retrieve files output to by model
        use outputs
        display ename for trim(ename1) = trim(rmod) .and. trim(etype1) = ;
        'MODEL' .and. trim(etype) = 'FILE' off
        ?
        ? Calls the following programs
        ?
        * retrieve programs called
        use calls
        display ename for trim(ename1) = trim(rmod) .and. trim(etype1) = ;
        MODEL .and. trim(etype) = 'PROGRAM' OFF
        ?
        ?
        * let user hit any key to get fresh prompt to run program again
        ? 'Strike any key to continue'
        WAIT TO GOAHEAD
        erase
        * turn printer off , it will be set back on above
        set print off
        SET TALK OFF
        endif

enddo
* PROGRAM SUMOFF.PRG
*
* purpose: to produce printed report on a office and all models used,
*          all models maintained, and reports used
*
* programmer: al noel
*
* files used: office, uses, maintains
*
SET TALK OFF
set color to 30,14
set format to screen
erase
store '          ' to space
* set up loop
store t to more
do while more
      * prompt user for office symbol to use
      ? Please enter the Office Symbol of the Office
```

```
        accept Hit the space bar and RETURN to quit to rmod
        erase
        * in rmod blank, quit program
        if rmod =  ' ' .or. rmod =
           erase
           clear
           release all
           return
        else
        * turn printer on
        set print on
        ? The Office , rmod
        ?
        ? 'Uses the following Models:'
        ?
        * retireve for models used by office
        use uses
        display ename for trim(ofc)  = trim(rmod)      .and. trim(etype) = 'MODEL';
        off
        ?
        ? 'Uses the following Reports:'
        ?
        * retireve for reports used by office
        display ename for trim(ofc) = trim(rmod) .and. trim(etype) = 'REPORT' off
        ?
        ? 'Maintains the following Models:'
        ?
        * retrieve on models maintained
        use maintains
        display mdl           for trim(ofc) = trim(rmod)    off
        ?
        ?
        ?
        ? 'Strike any key to continue'
        * prompt user for a strike of any key to go ahead with new prompt and run
        * of program
        WAIT TO GOAHEAD
        erase
        set print off
        SET TALK OFF
        endif

enddo
```

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